

# Key Scottish Environment Statistics



**2003**

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## Key Scottish Environment Statistics

Welcome to the third edition of '**Key Scottish Environment Statistics**'. This booklet is published annually and provides key data sets on the state of the environment in Scotland, with an emphasis on the trends over time wherever possible. The data are supplemented by text providing brief background information on environmental impacts and relevant legislation.

An **internet database** accompanies this booklet and contains additional statistics to those presented here. The database is updated throughout the year and so may contain more recent figures. Where possible, links are provided to data held on other websites. If the data are held locally, the site allows users to select specified years and parameters within the data, as well as providing commentary, source details, links and downloadable files. Access the site on:  
**<http://www.scotland.gov.uk/stats/envonline>**

A general directory of websites that provide environmental statistics for Scotland is available at:

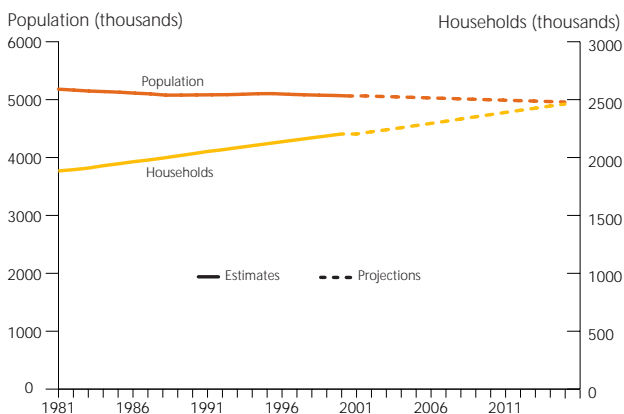
**<http://www.scotland.gov.uk/stats/envonline/links.asp>**

If you do not have internet access, please contact the Scottish Executive, Environment Statistics branch (details at the back of the booklet) and we will provide the requested data.

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## Population and Households: 1981-2014



	Thousands				
	Estimates <sup>1</sup>				Projections
	1981	1990	2000	2002	2014
<b>Population</b>	5,180	5,081	5,063	5,055	4,959
<b>Households</b>	1,884	2,032	2,203	–	2,462

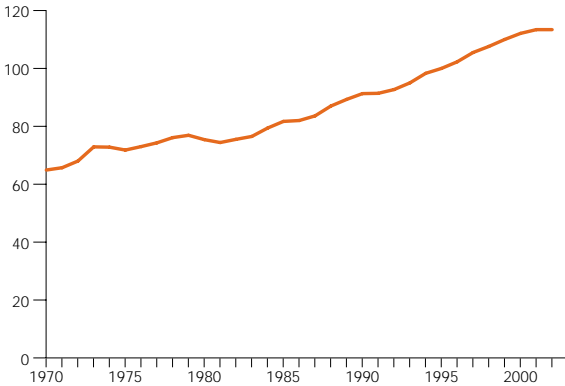
People and households are large consumers of energy and water resources, a demand that can put great strains upon the environment. The population of Scotland underwent a steady decline through most of the 1980s, followed by small increases in the seven years up to 1995. Since then, the population decreased to 5.05 million in 2002. The 2001-based projection<sup>2</sup> is for the population to fall to 4.96 million by 2014. The slow but steady population decline reflects a combination of net migration losses and the increasing excess of deaths over births. This trend contrasts with the overall UK population, which is projected to increase by 4% between 2000 and 2014.<sup>3</sup>

The number of households rose steadily by 319,000 (17%) between 1981 and 2000. Projections based on 2000 figures suggest that, by 2014, if past trends continue, the number of households in Scotland will reach 2.46 million. This will contribute significantly to the demand for housing, not all of which can be accommodated on previously developed land. An increase in the number of households will also cause greater consumption of many goods and services that tend to be used by households rather than individuals.

SOURCE: GROS, SCOTTISH EXECUTIVE

## Gross Domestic Product (GDP): 1970-2002

Scottish GDP (1995=100)



	1970	1980	1990	2000	2001	2002
<b>Scottish GDP<sup>4</sup></b>	64.9	75.4	91.3	112.1	113.4	113.4
<b>(1995 = 100)</b>						

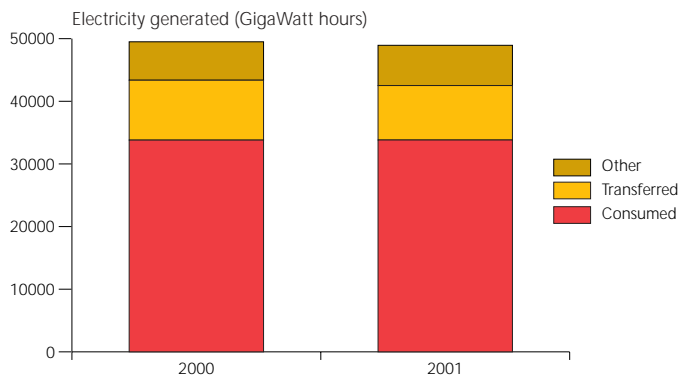
Maintaining economic growth is an important aspect of sustainable development. A healthy economy leads to higher living standards and greater prosperity for individuals. It also helps businesses to be profitable, which generates employment and income.

Gross Domestic Product (GDP) is important in measuring the activity and strength of the economy. However, a high GDP does not necessarily imply an efficient use of resources.

Between 1974 and 2002 (similar points in the economic cycle), the Scottish GDP increased from 72.8 to 113.4, representing an average annual growth of 1.6%. The rate of growth has varied over the period 1974-2002. For example, between 1985 and 1990 and between 1995 and 2000 annual growth averaged 2.3% per year.

SOURCE: SCOTTISH EXECUTIVE

## Electricity Generated and Consumed: 2000-2001



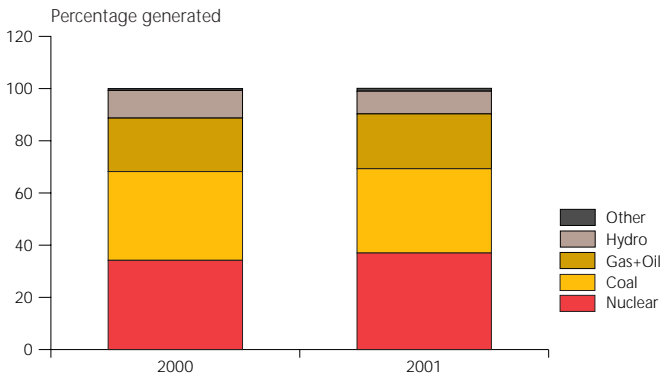
	GigaWatt hours	
	2000	2001
<b>Electricity consumed</b>	33,807	33,820
<b>Electricity transferred</b>	9,561	8,694
<b>Other<sup>5</sup></b>	6,131	6,424
<b>Total electricity generated</b>	49,499	48,938

Energy consumption figures for Scotland are not available, but electricity consumption can be used as a proxy measure. Figures supplied by the electricity generating companies show that just under 50,000 GWh of electricity was generated in Scotland in 2000 and 2001. About 34,000 GWh (70%) of this electricity was consumed by customers in Scotland. With capacity exceeding demand, about 18% of the electricity generated in Scotland was transferred to England and Wales. A further 6,000 GWh were accounted for by transmission and distribution losses, pumped storage and own use, and major power producers purchases from other generators.

In 2000 and 2001, over 50% of the electricity generated in Scotland was produced by fossil fuel combustion, which emits large quantities of greenhouse gases (GHGs). The UK is committed to reducing emissions of GHGs under the 1997 Kyoto Protocol.

SOURCE: DEPARTMENT OF TRADE AND INDUSTRY

## Electricity Generation by Source: 2000-2001



	Percentage	
	2000	2001
<b>Nuclear</b>	34.2	37.0
<b>Coal</b>	34.0	32.3
<b>Gas and Oil</b>	20.5	21.0
<b>Hydro<sup>6</sup></b>	10.6	8.7
<b>Other<sup>7</sup></b>	0.7	1.1

The combustion of fossil fuel, especially coal, is a major contributor to carbon dioxide emissions. Carbon dioxide is one of a basket of six greenhouse gases that the UK is committed to reduce under the 1997 Kyoto Protocol.

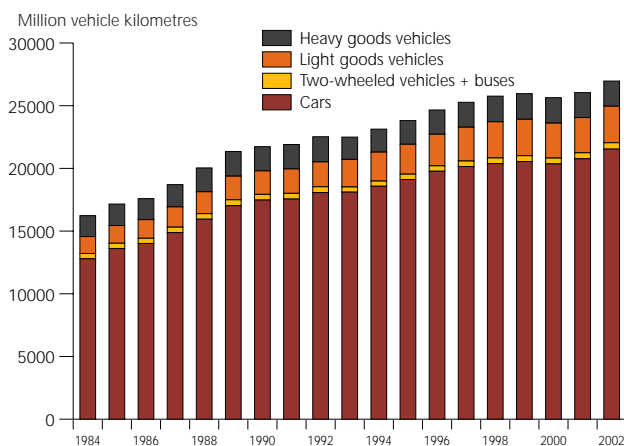
In 2000 and 2001, over 50% of electricity generated in Scotland was produced from fossil fuels. These figures may be higher than normal, due to the fact that refurbishment at nuclear plants meant that the nuclear sector generated less electricity than in previous years. To compensate, higher than usual amounts of coal were used to generate electricity.

Nuclear power does not emit greenhouse gases although its use raises other environmental issues, such as the long-term disposal of spent fuel. In 2000 and 2001, over a third of the electricity generated in Scotland came from nuclear fuel.

About 10% of the electricity generated in Scotland came from renewable sources (mainly hydroelectric). As part of the Climate Change Programme, the Scottish Executive is committed to generating 18% of electricity from renewable sources by 2010 and 40% by 2020.

SOURCE: DEPARTMENT OF TRADE AND INDUSTRY

## Motor Traffic on Major Roads: 1984-2002



Million vehicle kilometres<sup>8</sup>

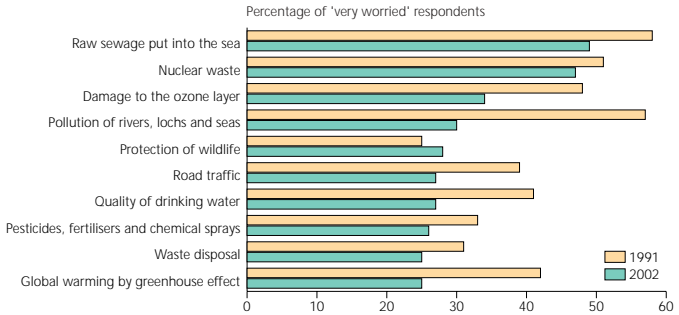
Vehicle type	1984	1990	1995	2001	2002
<b>Cars</b>	12,794	17,476	19,114	20,766	21,536
<b>Two-wheeled vehicles</b>	161	121	122	159	178
<b>Buses</b>	258	330	303	318	331
<b>Light goods vehicles</b>	1,351	1,873	2,383	2,812	2,913
<b>Heavy goods vehicles</b>	1,670	1,932	1,889	1,987	2,006
<b>Total</b>	16,234	21,731	23,811	26,042	26,964

The pollutants emitted by road transport contribute greatly to poor air quality that damages human and ecosystem health. Transport emissions also contain carbon dioxide and other greenhouse gases (GHGs), which contribute to climate change. Leaded petrol was banned in the UK on 1 January 2000 as part of the European Strategy to reduce pollution from road traffic. A reduction in the volume of road traffic would also help to achieve reductions in GHG emissions and concentrations of atmospheric pollutants.

The volume of traffic on major roads (motorways and 'A' roads) in Scotland has increased by 66% since 1984. Major roads account for roughly two-thirds of the volume of motor traffic in Scotland. In addition, minor roads ('B', 'C' and unclassified) have approximately 14 billion vehicle kilometres of traffic per year. Cars account for roughly 80% of road traffic.

SOURCE: DEPARTMENT FOR TRANSPORT, SCOTTISH EXECUTIVE<sup>9</sup>

## Public Concern about Environmental Issues: 1991 and 2002



Percentage of 'very worried' respondents

Issue	1991	2002
<b>Raw sewage put into the sea</b>	58	49
<b>Nuclear waste</b>	51	47
<b>Damage to the ozone layer</b>	48	34
<b>Pollution of rivers, lochs and seas</b>	57	30
<b>Protection of wildlife</b>	25	28

Respondents to the 2002 survey of Public Attitudes to the Environment in Scotland<sup>1</sup> were asked how concerned they were with 23 environmental issues. The chart above shows the 10 issues that caused most concern. It also compares responses from a corresponding survey in 1991.<sup>2</sup>

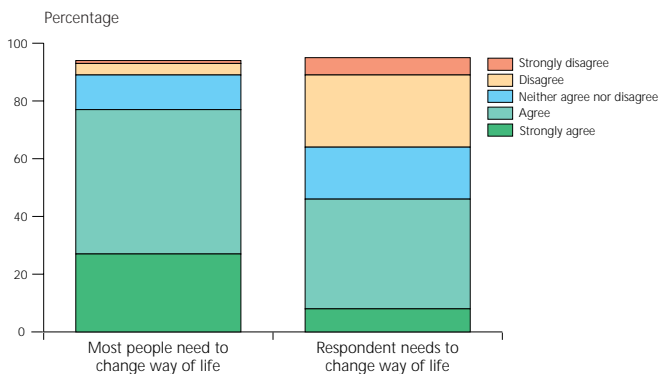
In 2002, raw sewage put into the sea was the issue that caused most concern. Nearly half (49%) of those surveyed were 'very worried' about this issue. Other issues dealing with pollution and waste also caused concern. For example, 47% were 'very worried' about nuclear waste and 30% were 'very worried' about pollution of Scottish rivers, lochs and seas.

Public concern about many individual environmental issues fell between 1991 and 2002. For example, in 1991 42% of respondents were 'very worried' about global warming, compared with 25% in 2002.

The issues that caused least concern in 2002 (not shown on the chart) were fish farming (7% 'very worried'), lack of access to parks (10%), farming methods (11%) and forestry (11%).

SOURCE: SCOTTISH EXECUTIVE

## Attitudes to Changing Way of Life: 2002



	Percentage	
	Most people need to change	Respondent needs to change
<b>Strongly agree</b>	27	8
<b>Agree</b>	50	38
<b>Neither agree nor disagree</b>	12	18
<b>Disagree</b>	4	25
<b>Strongly disagree</b>	1	6

Sustainable development is commonly defined as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs'.<sup>3</sup> There is growing recognition of the need for sustainable development at local and national level. This includes minimising the impact of our actions on future generations by reducing our use of resources and living within the capacity of the planet to sustain our activities.

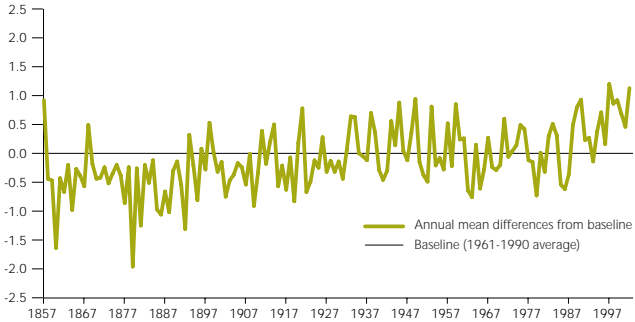
Respondents to the 2002 survey of Public Attitudes to the Environment in Scotland<sup>1</sup> were asked if they agreed there was a need to change current lifestyles so that future generations could continue to enjoy a good quality of life and environment.<sup>4</sup> Over three-quarters (77%) agreed that there was a need for most people in Scotland to change their way of life and 5% disagreed. However, less than half (46%) of the respondents agreed that they themselves needed to change their way of life and over three in ten (31%) disagreed.

The Scottish Executive has specified a set of 24 indicators to measure progress on sustainable development in Scotland.<sup>5</sup>

SOURCE: SCOTTISH EXECUTIVE

## Annual Land Temperature: 1857-2002

Annual mean temperature difference from 1961-1990 average (degrees Celsius)



	1857- 1900	1901- 1930	1931- 1960	1961- 1990	1991- 2002
<b>Annual temperature over period (°C)</b>	7.43	7.65	8.01	7.87	8.44
<b>Difference from 1961-1990 baseline (°C)</b>	-0.44	-0.22	0.14	0.00	0.57

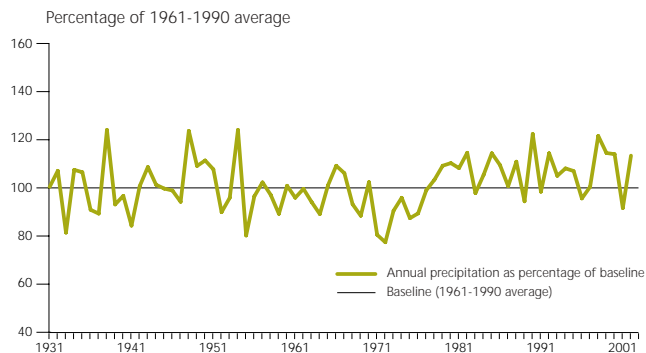
The balance between incoming solar energy and outgoing infrared radiation determines the earth's temperature. Changes in the amount of energy retained within the atmosphere affects global climate, which naturally exhibits long-term fluctuations. Current climate trends are unlikely to be entirely natural in origin, however, and there is now evidence that human activities are having a discernible impact on the global climate.<sup>1</sup>

Whilst the global impacts of climate change are considerable, there are also wide-ranging implications for Scotland. Flood risk, water resources, agriculture, tourism and health may be affected, all of economic, social and environmental importance.

Average global surface temperature has increased between 0.3°C and 0.6°C since the late 19th century,<sup>1</sup> and the trends in Scotland show a similar rise of about 1°C between the 1860s and 1990s. By 2100, temperatures in Scotland are predicted to rise by up to 3.5°C during the summer months and around 2.5°C during the winter months.<sup>2</sup>

SOURCE: MET OFFICE, UNIVERSITY OF EAST ANGLIA (CLIMATE RESEARCH UNIT)

## Annual Precipitation: 1931-2002



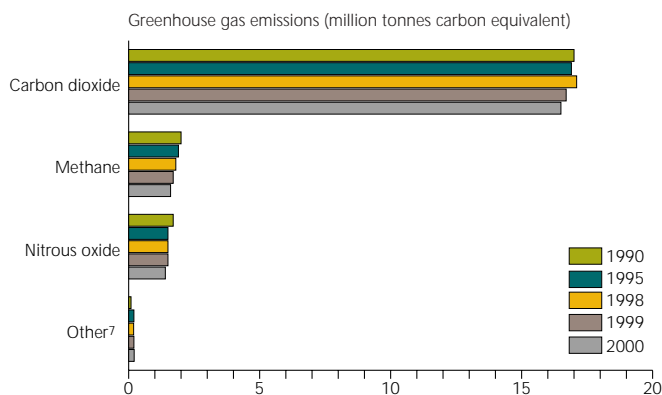
	1930s <sup>3</sup>	1940s	1950s	1960s
<b>Average annual precipitation</b>	1,350	1,373	1,342	1,320
<b>Percent of 1961-1990 baseline</b>	100.0	101.7	99.4	97.8
	1970s	1980s	1990s	2000s <sup>4</sup>
<b>Average annual precipitation</b>	1,262	1,439	1,468	1,436
<b>Percent of 1961-1990 baseline</b>	93.5	106.6	108.7	106.3

Global warming will have an effect on all weather patterns and changes in the amount of rainfall are predicted. The UK Climate Impacts Programme climate scenarios<sup>2</sup> indicate that rainfall patterns in Scotland will change to wetter winters and drier summers. It is estimated that winters will be over 30% wetter in some places, while summers will be up to 40% drier. Precipitation changes have several implications for Scotland, affecting water resources, flood and drought risk, and habitat loss.

The average annual precipitation in the 1980s and the 1990s was higher than in each of the previous five decades, particularly the 1970s, which contained several years with below average rainfall.

SOURCE: MET OFFICE, UNIVERSITY OF EAST ANGLIA (CLIMATE RESEARCH UNIT)<sup>5</sup>

## Greenhouse Gas Emissions:<sup>6</sup> 1990-2000



Emissions (million tonnes of carbon equivalent)

'Basket' of GHGs	1990	1995	1998	1999	2000 <sup>8</sup>
<b>Carbon dioxide (CO<sub>2</sub>)</b>	17.0	16.9	17.1	16.7	16.5
<b>Methane (CH<sub>4</sub>)</b>	2.0	1.9	1.8	1.7	1.6
<b>Nitrous oxide (N<sub>2</sub>O)</b>	1.7	1.5	1.5	1.5	1.4
<b>Hydrofluorocarbons (HFCs)</b>	0.00	0.03	0.09	0.10	0.11
<b>Perfluorocarbons (PFCs)</b>	0.07	0.14	0.07	0.07	0.07
<b>Sulphur hexafluoride (SF<sub>6</sub>)</b>	0.02	0.03	0.03	0.03	0.03
<b>Total</b>	20.8	20.5	20.6	20.1	19.8
<b>% of UK GHG emissions</b>	10.0%	10.7%	10.8%	11.1%	10.9%

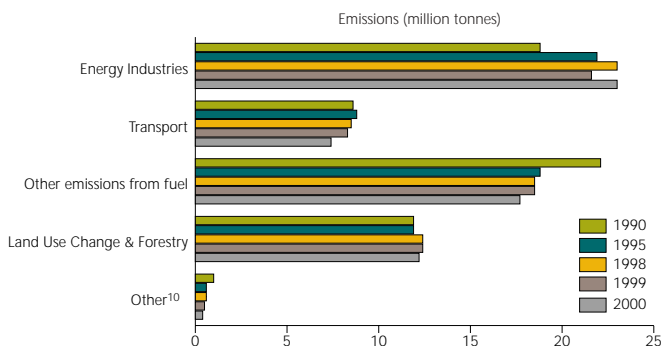
'Greenhouse' gases (GHGs) in the atmosphere help to retain radiation, resulting in warming of the lower atmosphere and earth surface. The process, known as the greenhouse effect, is essential to maintain global temperatures that sustain life on earth. Atmospheric concentrations of GHGs have increased as a result of human activities since the industrial revolution (c.1750). This has enhanced the greenhouse effect.

The Kyoto Protocol (1997) set legally binding targets under which the UK must reduce emissions of a 'basket' of six GHGs to 12.5% below the 1990 baseline level by 2008-2012.

Total greenhouse gas emissions weighted by Global Warming Potential (GWP)<sup>6</sup> for Scotland dropped by 1 million tonnes between 1990 and 2000, to 19.8 million tonnes of carbon equivalent.

SOURCE: NETCEN<sup>9</sup>

## Carbon Dioxide Emissions by Source: 1990-2000



Emissions (million tonnes)

Sector	1990	1995	1998	1999	2000
<b>Energy industries</b>	18.8	21.9	23.0	21.6	23.0
<b>Transport</b>	8.6	8.8	8.5	8.3	7.4
<b>Other emissions from fuel</b>	22.1	18.8	18.5	18.5	17.7
<b>Land use change &amp; forestry</b>	11.9	11.9	12.4	12.4	12.2
<b>Other<sup>10</sup></b>	1.0	0.6	0.6	0.5	0.4
<b>Total<sup>11</sup></b>	<b>62.3</b>	<b>62.0</b>	<b>62.8</b>	<b>61.4</b>	<b>60.7</b>

Carbon dioxide (CO<sub>2</sub>) is the main contributor to greenhouse gas emissions. The UK contributes 2% to total global CO<sub>2</sub> emissions.<sup>12</sup> In 2000, CO<sub>2</sub> made up 84% of all greenhouse gas emissions in the UK (weighted by global warming potential<sup>6</sup>). Scotland contributed 60.7 million tonnes of CO<sub>2</sub> (10.8%) to the UK total, a fall of 1.6 million tonnes from 1990 levels.

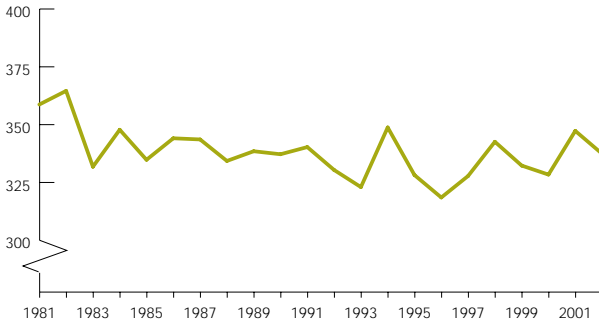
The energy industries are an important sector for CO<sub>2</sub> emissions in Scotland, generating CO<sub>2</sub> primarily from the combustion of fossil fuels. Emissions from the energy industries have increased by 22% since 1990.

Land use change and forestry also contributes to CO<sub>2</sub> emissions in Scotland, releasing 20% of emissions in 2000 (land use change being the main contributor). Scotland's carbon-rich soils represent an important UK carbon store, and release significant CO<sub>2</sub> through upland drainage and peat extraction.

SOURCE: NETCEN<sup>9</sup>

## Column Ozone Measurements: 1981-2002

Column ozone concentrations over Lerwick (Dobson units)



Column ozone concentrations (Dobson units)

Station	1981	1985	1990	1995	2000	2001	2002
Lerwick	358.7	334.8	337.2	328.2	328.4	347.3	337.4

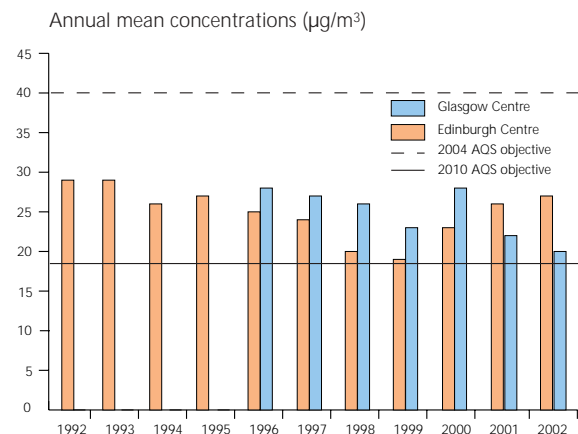
The stratospheric ozone layer, located around 8-30km above the Earth's surface, forms a protective shield against harmful solar (UVB) radiation.<sup>13</sup> Thinning of the ozone layer has occurred since the beginning of the 1980s in all regions except equatorial ones. Depletion is most marked in the Antarctic where, in 2000, the Antarctic ozone hole reached 28 million square kilometres in area (about 350 times the land area of Scotland).<sup>12</sup> Ozone depleting substances (ODS) include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons and halons, which are used as refrigerants, solvents, foam blowing agents and aerosol propellants.

The 1987 Montreal Protocol set guidelines to eliminate the global production and use of ODS. European production of CFCs for non-essential use fell to zero in 1995.<sup>12</sup> However, leaks from old equipment and the long life of these substances in the lower atmosphere mean that full recovery of the ozone layer is not predicted until 2050.

Over the last 20 years, total ozone cover over Lerwick has fluctuated. Record low levels were observed over Lerwick in March 1996. This has been attributed to local meteorological conditions and the passage of Arctic lower stratospheric air in which ozone had been depleted.

SOURCE: MET. OFFICE, NETCEN

## Particulate (PM<sub>10</sub>) Concentrations: 1992-2002



Site <sup>1</sup>	1992	1996	1999	2000	2001	2002
<b>Annual mean concentrations (<math>\mu\text{g}/\text{m}^3</math>)</b>						
<b>Glasgow Centre</b>	–	28	23	28	22	20
<b>Edinburgh Centre</b>	29	25	19	23	26	27
<b>Number of days exceeding <math>50\mu\text{g}/\text{m}^3</math></b>						
<b>Glasgow Centre</b>	–	8	9	27	13	8
<b>Edinburgh Centre</b>	6	14	3	5	11	15

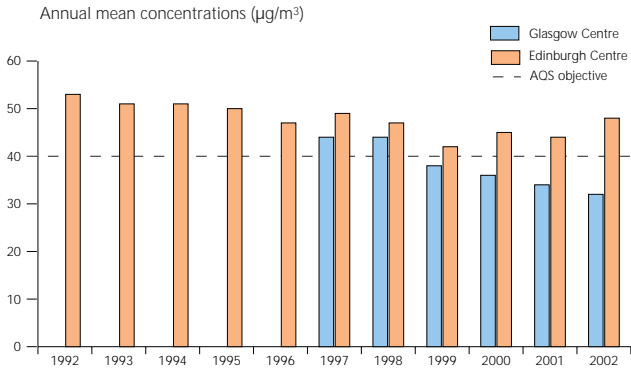
Particulate pollution can harm the human respiratory and cardiovascular systems, and is linked to asthma and mortality. Smaller particles are the most damaging and current targets focus on particles less than  $10\mu\text{m}$  in diameter (PM<sub>10</sub>).

The greatest source of PM<sub>10</sub> is combustion. In particular, road transport and domestic sources each account for around 20% of UK emissions of PM<sub>10</sub>.<sup>2</sup> Other sources are mining, construction, secondary reactions between nitrates and sulphates, and suspended dusts and pollen. Between 1990 and 2001, UK emissions of PM<sub>10</sub> fell by 44%.<sup>2</sup>

The Air Quality Strategy<sup>3</sup> objectives for PM<sub>10</sub> come in two stages. Stage 1 (to be met by the end of 2004): a 24-hour mean of  $50\mu\text{g}/\text{m}^3$  not to be exceeded more than 35 times a year, and an annual mean of  $40\mu\text{g}/\text{m}^3$ . Stage 2 (to be met by the end of 2010): a 24-hour mean of  $50\mu\text{g}/\text{m}^3$  not to be exceeded more than seven times a year, and an annual mean of  $18\mu\text{g}/\text{m}^3$ . Stage 1 objectives were met at all five automatic monitoring sites in 2002.

SOURCE: NETCEN

## Nitrogen Dioxide Concentrations: 1992-2002



Site <sup>4</sup>	1992	1995	1999	2000	2001	2002
	<b>Annual mean concentrations (<math>\mu\text{g}/\text{m}^3</math>)</b>					
Glasgow Centre	-	-	38	36	34	32
Edinburgh Centre	53	50	42	45	44	48
	<b>Hourly means exceeding <math>200\mu\text{g}/\text{m}^3</math></b>					
Glasgow Centre	-	-	3	2	0	18
Edinburgh Centre	0	3	0	1	8	0

High concentrations of nitrogen dioxide ( $\text{NO}_2$ ) can affect human health, particularly by causing inflammation of the airways. Ecosystem health is also damaged by  $\text{NO}_2$  by reducing plant growth, contributing to acid deposition and promoting the formation of ground level ozone.

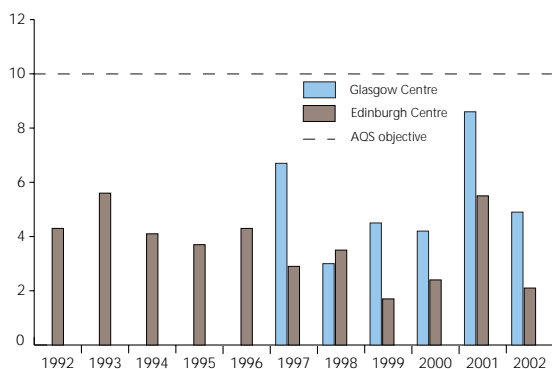
All combustion processes in air produce oxides of nitrogen ( $\text{NO}_x$ ). Road transport accounts for about half of all  $\text{NO}_x$  emissions in the UK; this contribution is greatly increased in urban areas. Between 1990 and 2001, UK emissions of  $\text{NO}_x$  decreased by 39%<sup>2</sup> due to the installation of catalytic converters in vehicles.

The Air Quality Strategy<sup>3</sup> objectives for  $\text{NO}_2$  (to be met by the end of 2005) are (1) an annual mean of  $40\mu\text{g}/\text{m}^3$  and (2) an hourly mean of  $200\mu\text{g}/\text{m}^3$  not to be exceeded more than 18 times a year. In 2002, the first objective was not met at three of the eight automatic monitoring sites in Scotland – Glasgow City Chambers, Glasgow Kerbside and Edinburgh Centre. The second objective was met at all automatic monitoring sites, except Glasgow Kerbside.

SOURCE: NETCEN

## Carbon Monoxide Concentrations: 1992-2002

8-hour running mean concentration



Site <sup>5</sup>	1992	1997	2000	2001	2002
	<b>Maximum 8-hour running mean (mg/m<sup>3</sup>)</b>				
Glasgow Centre	-	6.7	4.2	8.6	4.9
Edinburgh Centre	4.3	2.9	2.4	5.5	2.1
	<b>Annual mean (mg/m<sup>3</sup>)</b>				
Glasgow Centre	-	0.7	0.5	0.5	0.3
Edinburgh Centre	1.1	0.6	0.7	0.5	0.4

Carbon monoxide (CO) is a gas formed by the incomplete combustion of carbon-based fuels. The greatest threat to human health from exposure to CO is the formation of carboxyhaemoglobin. This reduces the capacity of the blood to carry oxygen resulting in drowsiness, headaches, and in severe cases unconsciousness and death.

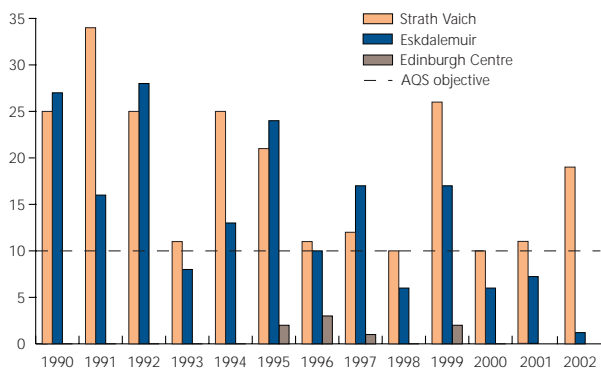
The Air Quality Strategy<sup>3</sup> (AQS) objective for CO is a maximum concentration of 10mg/m<sup>3</sup> measured as an 8-hour running mean, to be achieved by the end of 2003. In 2002, this objective was met at all seven automatic monitoring sites in Scotland.

The main outdoor source of carbon monoxide is currently road transport, in particular petrol-fuelled vehicles, which in 2001 accounted for 62% of UK emissions.<sup>2</sup> Between 1990 and 2001, UK emissions of CO from road transport have fallen by 57%, a decline attributed to the installation of catalytic converters in vehicles.

SOURCE: NETCEN

## Ground Level Ozone Concentrations: 1990-2002

Number of days exceeding  $100\mu\text{g}/\text{m}^3$  (maximum 8-hour mean)



Site <sup>6</sup>	1990	1995	1999	2000	2001	2002
<b>Number of days exceeding <math>100\mu\text{g}/\text{m}^3</math> (8-hour running mean)</b>						
<b>Strath Vaich</b>	25	21	26	10	11	19
<b>Eskdalemuir</b>	27	24	17	6	7	1
<b>Edinburgh Centre</b>	–	2	2	0	0	0
<b>Average annual concentration (<math>\mu\text{g}/\text{m}^3</math>)</b>						
<b>Strath Vaich</b>	66	67	74	66	68	69
<b>Eskdalemuir</b>	55	55	56	47	46	48
<b>Edinburgh Centre</b>	–	31	35	30	30	35

Ozone in the stratosphere forms a layer that protects the earth against harmful ultra-violet radiation, but tropospheric (ground level) ozone is a damaging oxidant. Exposure to high ozone concentrations can cause respiratory damage, and affects vegetation by damaging leaves and reducing yields.

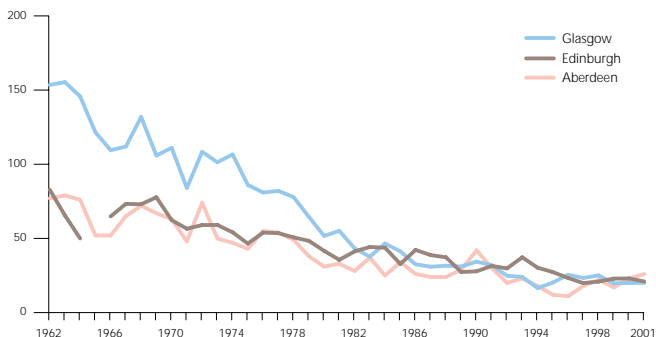
Ozone is formed by a slow, complicated series of reactions from other pollutants that may be blown over from Europe. The most important man-made precursors are nitrogen oxides and volatile organic compounds (VOCs) produced by road transport, industrial processes and solvent use. Ozone concentrations tend to be lower in urban areas where it is converted to nitrogen dioxide by reacting with nitrogen oxides.

The Air Quality Strategy<sup>3</sup> objective for ground level ozone (to be met by 2005) is for the maximum daily concentration (measured as an 8-hour running mean) of  $100\mu\text{g}/\text{m}^3$  not to be exceeded more than 10 times a year.<sup>7</sup> In 2002, this objective was met at all four monitoring sites in Scotland, except Strath Vaich.

SOURCE: NETCEN

## Sulphur Dioxide Concentrations: 1962-2002

Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )



Annual means (from non-automatic stations) ( $\mu\text{g}/\text{m}^3$ )

City	1962	1970	1980	1990	2000	2001
Glasgow	154	111	52	34	20	20
Edinburgh <sup>8</sup>	83	63	42	28	23	21
Aberdeen	77	63	31	42	23	26

Short-term records for AQS compliance

Site <sup>9</sup>	Number of 15-min means exceeding $266\mu\text{g}/\text{m}^3$				
	1995	1999	2000	2001	2002
Glasgow Centre	–	0	0	0	0
Edinburgh Centre	18	0	0	0	0
Grangemouth	–	–	–	7	28

The predominant source of atmospheric sulphur dioxide ( $\text{SO}_2$ ) is the combustion of sulphur-containing fossil fuels, mainly coal and heavy oils. Annual urban  $\text{SO}_2$  levels have fallen by around 75% since the 1956 Clean Air Act was introduced to combat smog.

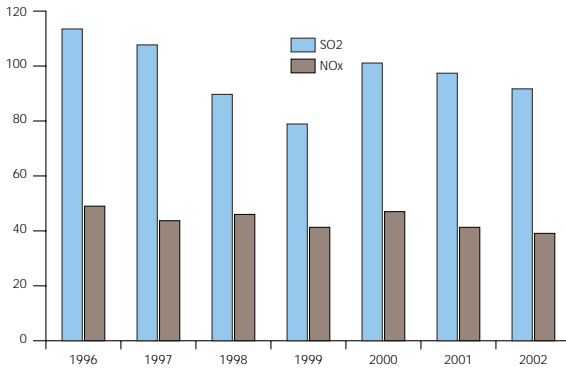
High  $\text{SO}_2$  levels over a short period of time are important as  $\text{SO}_2$  can cause respiratory difficulties almost immediately after exposure. The Air Quality Strategy<sup>3</sup> objective for  $\text{SO}_2$  stipulates that a 15-minute mean of  $266\mu\text{g}/\text{m}^3$  should not be exceeded more than 35 times a year (to be met by the end of 2005). All four automatic monitoring sites meet this objective.

In cold weather,  $\text{SO}_2$  can contribute to acidification that damages vegetation and ecosystems. The AQS objective for ecosystem protection, a winter (1 October-31 March) mean of  $20\mu\text{g}/\text{m}^3$ , is currently met at all Scottish automatic monitoring stations.

SOURCE: NETCEN

## Emissions of Sulphur Dioxide and Nitrogen Oxides from Large Combustion Plants:<sup>10</sup> 1996-2002

Annual LCP emissions (thousand tonnes)



Annual emissions (thousand tonnes)

Source	SO <sub>2</sub>			NO <sub>x</sub>		
	1996	1999	2002	1996	1999	2002
Electricity supply	99.1	67.0	87.7	44.7	36.3	35.3
Refinery	11.3	9.4	2.7	2.9	3.6	2.0
Other industry	3.1	2.5	1.3	1.4	1.4	1.8

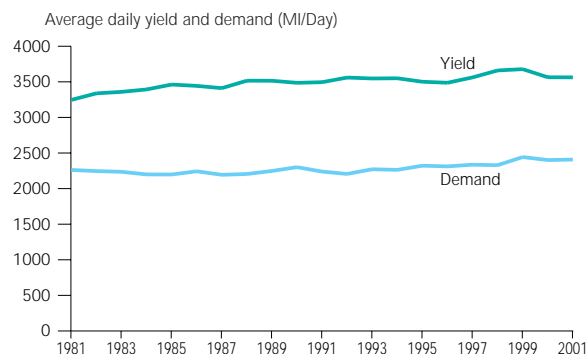
Sulphur dioxide (SO<sub>2</sub>) and oxides of nitrogen (NO<sub>x</sub>) affect human health through respiratory damage, and ecosystem health through acidification. SO<sub>2</sub> and NO<sub>x</sub> are released into the atmosphere through the combustion of fossil fuels. In 2001, large combustion plants (LCPs) accounted for 73% of the SO<sub>2</sub> emissions and 21% of NO<sub>x</sub> emissions in the UK.<sup>2</sup>

The revised EC LCP Directive (2001/80/EC) called for a 60% reduction in SO<sub>2</sub> emissions by 2003 and a 30% reduction in NO<sub>x</sub> emissions by 1998, from a 1980 baseline. By 2001, UK emissions for SO<sub>2</sub> and NO<sub>x</sub> were 76% and 63% respectively below 1980 levels.<sup>2</sup> In Scotland, SO<sub>2</sub> emissions from the electricity supply industry fell between 1996 and 1999, but rose in 2000. This was due to the increased use of coal-fired power stations, necessary to offset the reduced capacity of the nuclear sector because of refurbishment work at certain plants.

Acid deposition is a transboundary problem. In 1994, it was estimated that 81% of sulphur deposited in Scotland was emitted in other parts of Europe.<sup>11</sup> Similarly, most Scottish emissions are deposited elsewhere.

SOURCE: SCOTTISH ENVIRONMENT PROTECTION AGENCY

## Public Water Supplies, Yield and Demand: 1981-1982 to 2001-2002



### Average volume of water (Megalitres/day)

	1981-82	1990-91	1995-96	2000-01	2001-02
<b>Yield from developed water resources</b>	3,246	3,486	3,501	3,564	3,563
<b>Daily demand from public supplies</b>	2,262	2,301	2,322	2,401	2,408

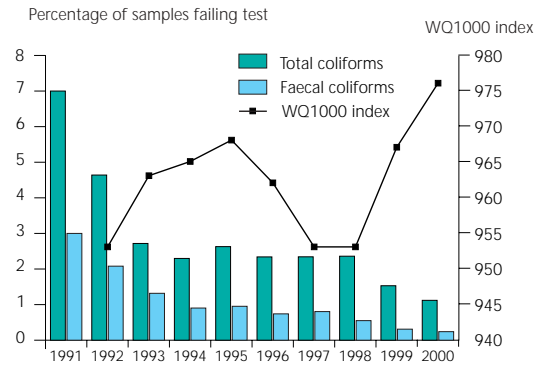
For sustainable management of water resources, it is essential to meet consumers' demand and standards, whilst maintaining aquatic ecosystem health. Abstraction of water has impacts on geology, habitats, wildlife, biodiversity, and recreational use of water resources. To prevent low flow levels downstream, minimum compensation flows need to be discharged at all times. Compensation flows are specified in the Water Orders made under the Water (Scotland) Act 1980.

Demand for water in Scotland has increased by 6% since 1981-1982, although yield from developed resources (representing the potential water available) is still greater than demand. For 2001-2002, daily demand includes an estimated 45% lost through leakage.

Water demand comes from unmetered and metered potable water, and small amounts of non-potable water. Unmetered demand (domestic use, small industries, public use, etc.) accounted for 78% of daily demand in 2001-2002, compared with 70% in 1981-1982. In contrast, metered demand decreased from 28% to 22% of daily demand. The decrease in metered demand may represent industry using less water to reduce water supply and waste water charges.

SOURCE: SCOTTISH EXECUTIVE WATER SERVICES UNIT<sup>1</sup>

## Drinking Water Quality: 1991-2000



	1991	1995	1998	1999	2000
<b>Number of samples taken (ooo's)</b>	227	231	180	143	152
<b>Percentage failure for all coliforms</b>	7.0	2.6	2.4	1.5	1.1
<b>Percentage failure for faecal coliforms</b>	3.0	1.0	0.6	0.3	0.2
<b>Water Quality 1000 index<sup>2</sup></b>	-	968	953	967	976

The coliform group of organisms is present in large numbers in the gut of all warm-blooded animals and therefore widely distributed in the environment. Their presence in tap water indicates a breach in the integrity of the water supply system.

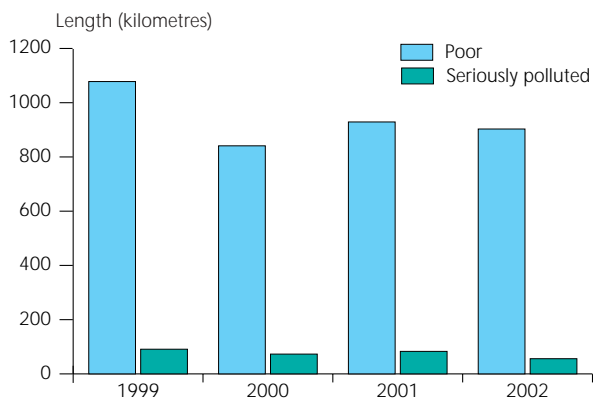
The 1990 Water Supply (Water Quality) (Scotland) Regulations set strict standards for compliance and the success rate varies across Scotland. The major centres of population are served by water treatment works, which are generally well equipped to achieve the standards set. Infrequent minor and low level failures with little implication occur at these works. Rural areas not served by treatment works can have water of variable quality.

The Water Quality 1000 index,<sup>2</sup> based on 10 key parameters including faecal and total coliforms, has fluctuated since 1992, but has been increasing since 1998, reaching 976 in 2000.

The standard set by the Water Supply Regulations, for 95% of samples to be free of all coliforms, has been met every year since 1992. However, the strict standard of zero faecal coliforms in all samples has not yet been achieved, with 0.2% of samples failing this test in 2000.

SOURCE: SCOTTISH EXECUTIVE WATER SERVICES UNIT<sup>3</sup>

## River Water Quality: 1999-2002



	Length (kilometres)			
Classification <sup>4</sup>	1999	2000	2001	2002
<b>Poor</b>	1,078	841	929	903
<b>Seriously polluted</b>	91	73	83	56
<b>Unclassified</b>	–	12,822	11,960	7,999
<b>Total length of network</b>	25,382	25,454	25,511	25,445

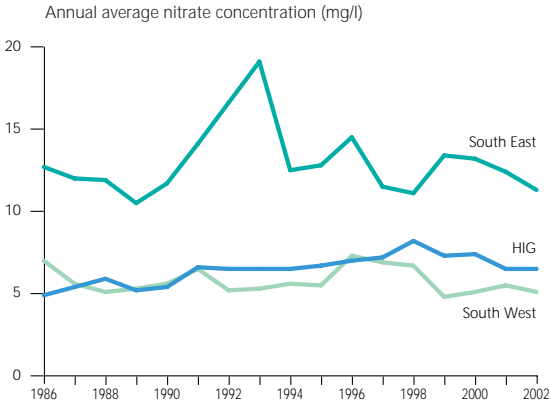
Low standards of river water quality may threaten the aquatic environment, drinking water quality and recreational water use. Sewage, industry, urban development and agriculture are some of the factors that may affect river water quality.

The Scottish Environment Protection Agency (SEPA) has established a Digitised River Network (DRN) to classify about 25,000km of the approximately 100,000km of rivers and burns in Scotland. The DRN comprises those watercourses draining a catchment of 10km<sup>2</sup> or more, and classifies rivers as *excellent*, *good*, *fair*, *poor* or *seriously polluted* according to measures of chemical, biological, nutrient and aesthetic quality.

Between 1999 and 2002, the length of poor and seriously polluted rivers in Scotland has fallen by 210km. SEPA has set a target of a reduction of 351km in poor and seriously polluted rivers for the period 1999-2006.<sup>5</sup> Poor biological and nutrient quality are the most frequent reasons for classifying rivers as poor or seriously polluted.

SOURCE: SCOTTISH ENVIRONMENT PROTECTION AGENCY

## Nitrate Concentrations in Rivers: 1986-2002



Annual average concentrations (mg/l) <sup>6</sup>					
SEPA Area	1986	1990	1995	2001	2002
South East	12.7	11.7	12.8	12.4	11.3
South West	7.0	5.6	5.5	5.5	5.1
Highlands, Islands & Grampian	4.9	5.4	6.7	6.5	6.5

The enrichment of waters by nutrients, such as nitrates and phosphates, can damage the aquatic environment through the accelerated growth of algae and other plant life. The rapid growth and subsequent decay of plant organisms depletes oxygen levels, which may have harmful effects upon fish and other aquatic life. This process is known as eutrophication.

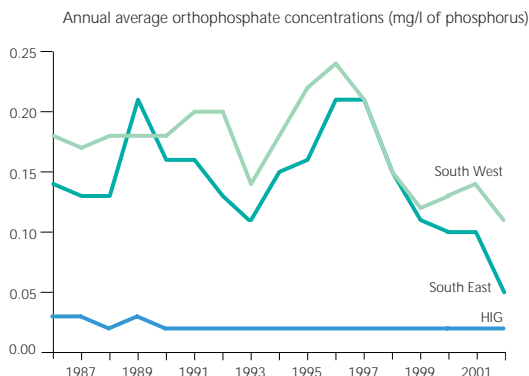
High nitrate levels have a greater impact on marine and coastal waters than freshwater, although nitrates in freshwater will eventually reach the sea. Nitrates in drinking water supplies also pose a risk to human health. The main source of nitrates in freshwater is run-off from agricultural land.

The highest average nitrate concentrations in rivers are found in the SEPA South East area. Concentrations in the South East and South West have fluctuated. In the Highlands, Islands & Grampian, there was a steady increase throughout much of the 1980s and 1990s, but levels have fallen since 1998.

Regulations have been made designating 14% of the area of Scotland<sup>7</sup> as Nitrate Vulnerable Zones (NVZs).<sup>8</sup> In NVZs, mandatory rules on farming practices aim to reduce nitrate water pollution from agricultural sources.

SOURCE: SCOTTISH ENVIRONMENT PROTECTION AGENCY

## Orthophosphate Concentrations in Rivers: 1986-2002



Annual average concentrations (mg/l of phosphorus equivalent)<sup>6</sup>

SEPA Area	1986	1990	1995	2001	2002
South East	0.14	0.16	0.16	0.10	0.05
South West	0.18	0.18	0.22	0.14	0.11
Highlands, Islands & Grampian	0.03	0.02	0.02	0.02	0.02

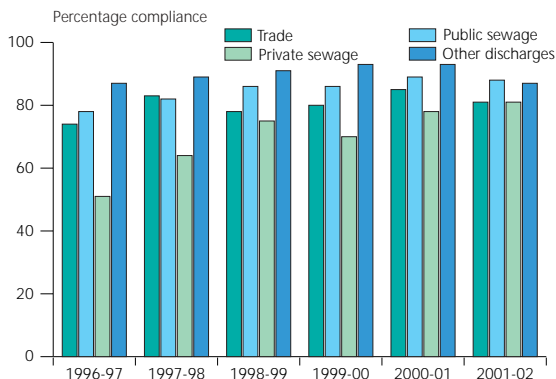
Excess phosphorus in freshwaters can lead to eutrophication. The main sources of phosphorus are outputs from sewage treatment works and diffuse pollution from agriculture. Orthophosphate levels provide a good indication of trends in total phosphorus.

Orthophosphate concentrations in the SEPA South East and South West areas show a similar trend over the period 1986-2002, with levels in the South West being slightly higher, in general. The fluctuating nature of the concentrations over the period may be due to factors such as the river flow variation between years. Since reaching a peak in 1996, orthophosphate concentrations in both areas have fallen. This decline may be partly due to the installation of phosphate-removal facilities at sewage treatment works.

Under the Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC), the Ythan Estuary, Dean Water, South Calder Water, River Almond, the lower part of the River Don and their respective catchments are all designated sensitive areas. Discharges into waters that have been designated as sensitive require additional treatment to remove nutrients.

SOURCE: SCOTTISH ENVIRONMENT PROTECTION AGENCY

## Effluent Compliance with Discharge Consents: 1996-1997 to 2001-2002



Samples complying with relevant standards (Percentage)

Type of discharge consent	96-97	97-98	98-99	99-00	00-01	01-02
Trade effluent	74	83	78	80	85	81
Public sewage	78	82	86	86	89	88
Private sewage	51	64	75	70	78	81
Other discharges <sup>9</sup>	87	89	91	93	93	87
All discharges	73	80	82	82	86	85

Under the Control of Pollution Act (1974) it is an offence to cause or knowingly permit discharge of poisonous, noxious or polluting substances to controlled waters in Scotland. Discharges of sewage and trade effluent into controlled waters, including all coastal and inland waters may, however, be made under a discharge consent authorised by the Scottish Environment Protection Agency (SEPA). Authorisations contain conditions on both the quality and quantity of effluent permitted. SEPA control these discharges through licensing and monitoring.

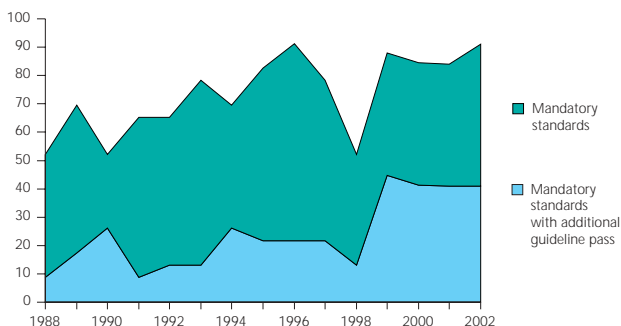
Point source sewage effluent is currently the most important source of pollution affecting tidal waters in Scotland.

The overall compliance rate increased from 73% in 1996-1997 to 85% in 2001-2002. Compliance rates for trade effluent and public sewage discharges have risen by 7% and 10% respectively since 1996-1997. Private sewage discharges show a 30% increase in compliance rates since 1996-1997. SEPA has set a target of 95% compliance for licences issued under the Control of Pollution Act by 2003-04.<sup>10</sup>

SOURCE: SCOTTISH ENVIRONMENT PROTECTION AGENCY

## Compliance with the EC Bathing Water Directive (76/160/EEC): 1988-2002

Percentage Compliance of Coastal Bathing Water



	1988	1995	2000	2001	2002
<b>Mandatory standard compliance (%)</b>	52	83	84	84	91
<b>Guideline standard (%)</b>	9	22	41	41	41
<b>Failure to comply (%)</b>	48	17	16	16	9
<b>Number of identified coastal bathing waters<sup>11,12</sup></b>	23	23	58	58	58

High quality bathing waters are important for a wide variety of interests and support Scotland's tourism industry. Monitoring the quality of these waters provides an indication of the health risks of bathing from both direct and diffuse discharges of effluents containing faecal contaminants.

EC Bathing Water Directive (76/160/EEC) sets out two quality standards – the 'mandatory' standard, and the stricter 'guideline' standard. Member states should comply with the mandatory standard and aim to comply with the guideline standard.

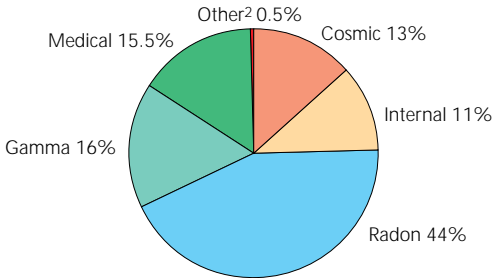
In 2002, 91% of identified coastal bathing waters achieved the mandatory standard, and 41% also complied with the guideline standard. The 2002 compliance rate for the mandatory standard is the highest on record, along with 1996.

It is important to note that the weather is thought to affect compliance, with poorer results often associated with high rainfall.

SOURCE: SCOTTISH ENVIRONMENT PROTECTION AGENCY

## Exposure of the Population from All Sources of Radiation: 1997<sup>1</sup>

Average annual dose in Scotland, 2,400 microSieverts



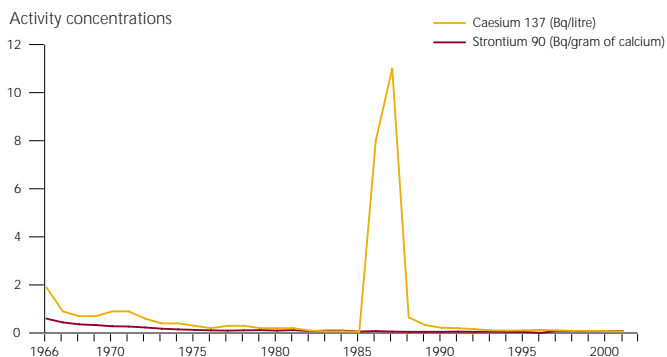
Average annual dose (microSieverts)			
Natural sources	$\mu\text{Sv}$	Artificial sources	$\mu\text{Sv}$
Radon	1,040	Medical	370
Gamma rays	390	Occupational	6
Cosmic	320	Fallout	4
Internal (from diet)	270	Disposals	0.3
		Consumer products	0.1

The average annual dose of radiation to someone living in Scotland is 2,400 microSieverts, 84% of which comes from natural sources. The main source of natural radiation exposure is radon, a radioactive gas that is emitted from tiny amounts of uranium naturally present in materials such as rocks, soils, bricks and concrete. Radon decays and emits short-lived products that can increase the risk of lung cancer. The action level for radon in the home is  $200\text{Bq}/\text{m}^3$ , above which, measures should be taken to reduce concentrations. Other important natural sources of radiation are cosmic rays, terrestrial gamma rays and long-lived radionuclides that enter the body through food and drink.

The greatest artificial source of exposure to radiation comes from medical x-rays. Nuclear waste disposals and fall-out account for less than 0.2% of exposure. The Chernobyl reactor incident in 1986 caused average annual doses from fall-out to increase by about five times that year.

SOURCE: NATIONAL RADIOLOGICAL PROTECTION BOARD

## Activity Concentrations in Milk: 1966-2001<sup>3</sup>



Activity concentrations in milk

	1966	1975	1987	2001
<b>Caesium 137 (Bq/litre)</b>	1.90	0.30	11.00	<0.073
<b>Strontium 90 (Bq/gram of calcium)</b>	0.60	0.13	0.06	<0.083

Exposure to high levels of ionising radiation from radioactive substances can lead to radiation sickness and is associated with genetic damage that can cause cancer.

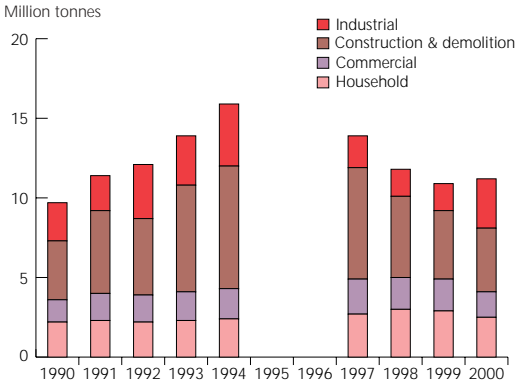
To monitor exposure to radionuclides through the diet, activity concentrations in cows' milk are valuable indicators. Between 1966 and 1980, there were gradual falls in the concentrations of caesium-137 ( $^{137}\text{Cs}$ ) and strontium-90 ( $^{90}\text{Sr}$ ). This reflects a decline in atmospheric radioactive fall-out, following the ban on above-ground nuclear weapons testing under the 1963 Partial Test Ban Treaty between the UK, USA and former USSR.

Activity levels of  $^{137}\text{Cs}$  in milk peaked following the Chernobyl reactor incident in 1986, with 1987 levels 220 times greater than in 1985.<sup>4</sup> Concentrations then fell rapidly in 1988, and are now below pre-Chernobyl levels.

Community Food Intervention Levels (EC/686/95) set post-accident activity levels for food at which intervention should occur. In milk, these are 1000 Bq/kg (1030 Bq/l) for  $^{137}\text{Cs}$  and 125 Bq/kg (1.01 Bq/g of calcium) for  $^{90}\text{Sr}$ . Peak concentrations in milk are now well below the EC intervention levels, which were derived to ensure public protection.

SOURCE: NATIONAL RADIOLOGICAL PROTECTION BOARD

## Sources of Waste Sent to Landfill: 1990-2000<sup>1</sup>



Million tonnes

	1990	1994	1999	2000
<b>Household</b>	2.2	2.4	2.9	2.5
<b>Commercial</b>	1.4	1.9	2.0	1.6
<b>Construction and demolition</b>	3.7	7.7	4.3	4.0
<b>Industrial</b>	2.4	3.9	1.7	3.1
<b>Other</b>	–	–	0.1	0.1
<b>Total<sup>2</sup></b>	9.7	15.9	10.9	11.2

The disposal of waste to landfill can result in the loss of many tonnes of valuable materials, release pollutants into the soil and watercourses, and emit methane, a greenhouse gas.

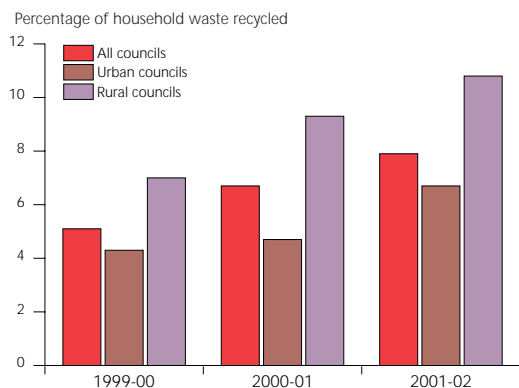
The National Waste Strategy<sup>3</sup> places disposal to landfill at the bottom of its waste hierarchy. The main route for waste disposal in Scotland, however, is landfill, with over 11 million tonnes deposited in 2000. Construction and demolition accounted for 4 million tonnes (35%) of this total. Household waste accounted for 22% of the total in 2000.

The EU Landfill Directive (1993/31/EC) requires a reduction in the amount of biodegradable municipal waste (BMW) sent to landfill. By 2010, only 75% of BMW should go to landfill, 50% by 2013 and 35% by 2020, compared to a 1995 baseline.<sup>4</sup>

The Landfill tax was introduced in 1996 in order to discourage the disposal of waste to landfill. The tax rate was increased to £10 per tonne for biodegradable waste in 1999, and will continue to rise by £1 each year until 2004, when it will increase to £18.

SOURCE: SCOTTISH OFFICE,<sup>5</sup> SCOTTISH ENVIRONMENT PROTECTION AGENCY<sup>6</sup>

## Local Authorities Recycling of Household Waste: 1999-2000 to 2001-2002



Percentage recycled

	1999-2000	2000-2001	2001-2002
<b>Rural councils</b> <sup>7</sup>	7.0	9.3	10.8
<b>Urban councils</b> <sup>7</sup>	4.3	4.7	6.7
<b>All councils</b>	5.1	6.1	7.9

The strong dependence on landfill for waste management in Scotland is not sustainable since it involves the depletion of both renewable and finite natural resources. In addition, extracting and processing raw materials may consume large quantities of energy, release pollutants and destroy landscapes and ecosystems. Reducing, reusing and recovering waste are key sustainable development objectives.

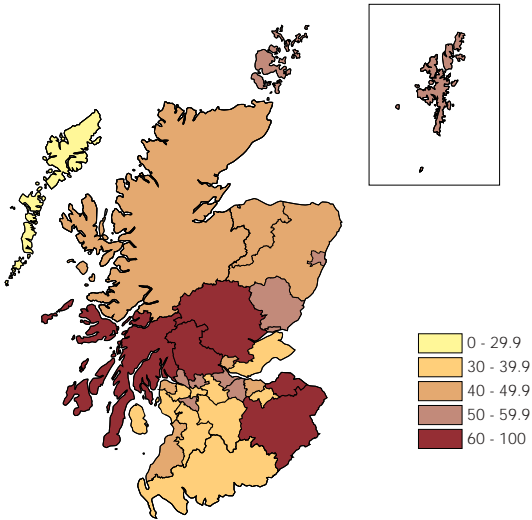
Councils obtain waste for recycling by collections at recycling centres (e.g. bottle banks), separate kerbside collection of recyclable materials, or separating waste after collection. In 2001-2002, 7.9% of all household waste collected in Scotland was recycled. A further 2.4% of household waste was used for the recovery of heat, power and other energy sources. The remaining 89.6% was sent to landfill. Rural councils generally recycle more household waste than urban councils. In 2001-2002, rural councils recycled 10.8% of household waste.

In the National Waste Plan,<sup>8</sup> the Executive has set a target of 25% of municipal waste to be recycled by 2006. In 2001-2002, 7.4% of municipal waste, which includes household, commercial and industrial waste, was recycled.<sup>9</sup>

SOURCE: ACCOUNTS COMMISSION FOR SCOTLAND<sup>10</sup>

## Waste Recycling Behaviour: 2000-2002

% of respondents to 2001 and 2002 surveys who recycled waste, by local authority



Respondents who had recycled waste items in past month (%)

Item	2000	2001	2002
Glass	29	28	31
Paper	30	30	33
Plastic	6	6	8
Cans	9	8	10
One or more of above items	43	43	45

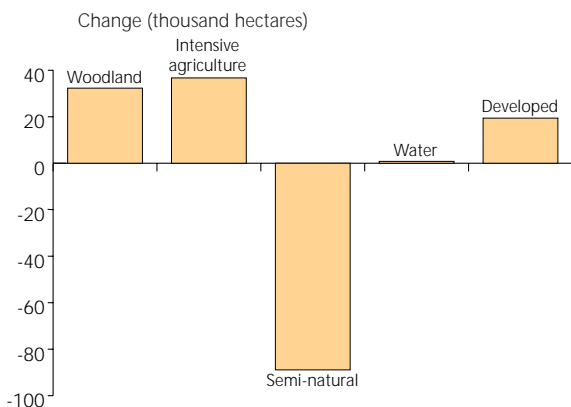
The reduction, reuse and recycling of household waste are key sustainable development objectives. The Scottish Household Survey<sup>11</sup> provides information on recycling behaviour. Respondents were asked which, if any, of certain waste items they had recycled from home in the past month.

In 2002, 45% of those surveyed said they had recycled some material in the past month. Nearly a third had recycled glass and paper waste, while about one in 10 had recycled plastic and cans.

The chart shows the percentage of respondents who said they recycled some waste material, by local authority area, averaged over years 2001 and 2002.

SOURCE: SCOTTISH HOUSEHOLD SURVEY (DATA), GROS (MAP BOUNDARIES)

## Broad Habitat Change: 1990-1998



Habitat	Area (thousand hectares)	
	1998	Change (1990-98) <sup>1</sup>
Woodland	1,294	32.3
Intensive agriculture	1,691	36.7
Semi-natural	4,535	-88.9
Water	106	0.8
Developed	276	19.4

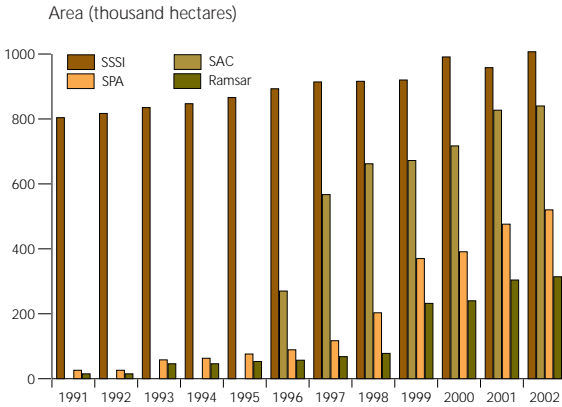
A classification of 'broad habitat' was defined for consistent reporting and monitoring of priority habitats that were identified under the UK Biodiversity Action Plan.<sup>2</sup> The habitats range from developed land, such as built-up areas and gardens, to semi-natural land, such as grasslands, bog and bracken. The Countryside Survey 2000<sup>3</sup> reported the status of 16 of the 20 broad habitats occurring in Scotland.

Over the period 1990-1998, the largest change was the overall decrease in semi-natural habitats of nearly 90,000 hectares. There was a decrease of 5% in the area of dwarf shrub heaths. Grassland losses also contributed to the overall decline in semi-natural habitats. However, there is no clear evidence that any of these declines are statistically significant. Some semi-natural habitats increased over the period, with fens, marshes and swamps showing a significant increase of 19%.

Woodland, developed habitats and land used for intensive agriculture all increased over the period, with a significant 9% increase in the area of broadleaved, mixed and yew woodland.

SOURCE: COUNTRYSIDE SURVEY 2000<sup>3</sup>

## Designated Areas: 1991-2002



Area (thousand hectares)

	1991	1995	1999	2000	2001	2002
<b>SSSI</b>	804	866	920	991	958	1,007
<b>SAC</b>	–	–	672	718	827	840
<b>SPA</b>	26	76	370	391	476	520
<b>Ramsar</b>	15	53	232	240	304	314

Site of Special Scientific Interest (SSSI) is the main nature conservation designation in Great Britain. Under the 1981 Wildlife and Countryside Act, the sites are notified as areas of outstanding quality to protect their flora, fauna, geological or physiographical features. At 31 March 2002, there were 1,447 SSSIs in Scotland, covering a total of 1,007,000 hectares (13% of land in Scotland).

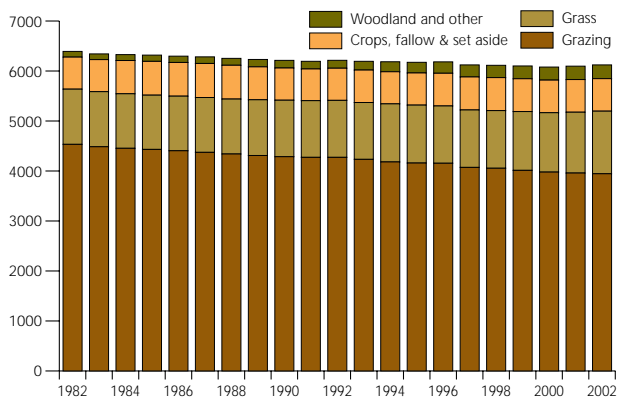
Special Area of Conservation (SAC) sites are designated under the 1992 EC Habitats Directive to protect wildlife and their habitats throughout the EU. Special Protection Area (SPA) sites are designated under the 1979 EC Wild Birds Directive to safeguard naturally occurring and migratory species of birds. Ramsar sites are designated under the Convention on Wetlands of International Importance to protect the habitats of waterfowl. At 31 March 2002, there were 222 SACs, 132 SPAs and 51 Ramsar sites in Scotland.

A designated site may be protected by more than one scheme. For example, it is estimated that about 65% of land designated as SAC is also designated as SSSI. Similarly, some 90% of the area of SPA land is also included in SSSI land.

SOURCE: SCOTTISH NATURAL HERITAGE<sup>4</sup>

## Agricultural Land Use: 1982-2002

Area (thousand hectares)



	Area (thousand hectares)				
	1982	1990	1995	2001	2002
<b>Grazing</b>	4,533	4,286	4,159	3,959	3,945
<b>Grass</b>	1,104	1,130	1,159	1,217	1,252
<b>Crops, fallow and set-aside</b>	641	644	643	653	650
<b>Woodland and other</b>	114	153	213	268	275
<b>Total land<sup>5</sup></b>	6,392	6,213	6,174	6,096	6,121
<b>Set-aside land<sup>6</sup></b>	–	17.9	80.2	96.1	86.3

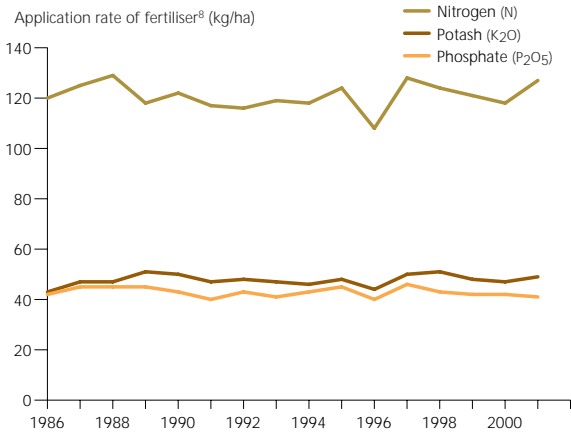
Agricultural land use has a strong influence on the landscape and environment of Scotland. In particular, changes in agricultural land use have an impact on wildlife habitats, water pollution, and emissions of the greenhouse gas carbon dioxide.

Between 1982 and 2002 the total land used for agriculture in Scotland decreased by 4%, although woodland areas more than doubled. In addition, the amount of land set-aside increased to 86,300 ha, mostly due to the Arable Area Payment Scheme (AAPS), whereby farmers are paid area aid to take land out of agricultural production. AAPS is designed primarily as a production control mechanism, and the standard set-aside rate has been fixed at 10% for the period 2000-2004.

The increase in woodland area and set-aside land, and the involvement in agri-environment schemes may have helped to reduce the impact of agriculture on the environment.

SOURCE: SCOTTISH EXECUTIVE ENVIRONMENT AND RURAL AFFAIRS DEPT

## Fertiliser Application to Crops and Grass:<sup>7</sup> 1986-2001



Application rate of fertiliser (kg/ha)<sup>8</sup>

	1986	1990	1995	1999	2000	2001
<b>Nitrogen (N)</b>	120	122	124	121	118	127
<b>Phosphate (P<sub>2</sub>O<sub>5</sub>)</b>	42	43	45	42	42	41
<b>Potash (K<sub>2</sub>O)</b>	43	50	48	48	47	49
<b>Total Fertiliser</b>	205	215	217	211	207	217

Fertilisers contain nutrients, such as nitrogen and phosphorus, which improve plant growth and crop yields. The inappropriate or mistimed use of fertilisers may cause nutrient enrichment and eutrophication of waters. Excess nitrates in drinking water are also a danger to human health. The EC Nitrates Directive (91/676/EEC) provides a framework to protect water bodies from agricultural nitrate pollution. This includes the designation of Nitrate Vulnerable Zones, where mandatory practises of fertiliser use are implemented.

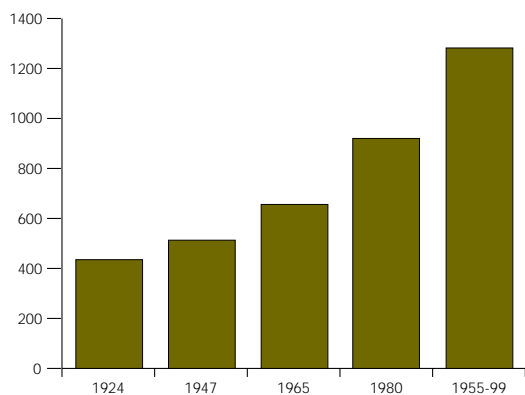
The total application rate of fertiliser together with the amount of agricultural land provides an estimate of the tonnage of fertiliser used each year. Changes in an overall application are due to the (actual) field areas of application used on farms, or to a change in the dressing cover, or to changes in both. Weather and economic factors may also contribute to changes in fertiliser use.

Overall between 1986 and 2001, total fertiliser application rates have been relatively stable. In 2001, total application rates were 217kg/ha, of which nitrogen contributed 59%.

SOURCE: SCOTTISH EXECUTIVE<sup>9</sup>

## Area of Woodland: 1924-1999

Area (thousand hectares)



	1924	1947	1965	1980	1995-99
<b>Area (ooo hectares)</b>	435	513	656	920	1,282
<b>% of total land</b>	5.6	6.6	8.4	11.8	16.4

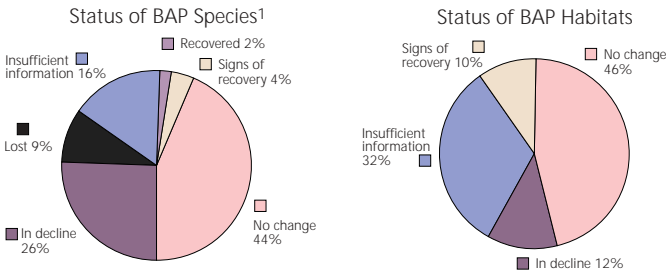
The amount of woodland<sup>10</sup> is of significant environmental importance. The extent of forestry has wide ranging effects on wildlife habitats, the physical environment and is an indication of the development of sustainable paper and timber production. In addition, woodland has aesthetic and recreational properties.

Woodland is managed by the Forestry Commission, other public bodies (including other government departments and local authorities), and private owners. The Forestry Commission manages just over a third of woodland in Scotland. Planting and management of non-Forestry Commission woodland is normally carried out with the assistance of government grants. Over 45% of Scotland's woodland area is certified as sustainably managed.

Five woodland censuses have been carried out in the period 1924-1999. The 1995-1999 National Inventory of Woodland and Trees showed that 16.4% of the total land area of Scotland was woodland, nearly three times as much as in 1924.

SOURCE: FORESTRY COMMISSION<sup>11</sup>

## Status of BAP Species & Habitats: 1996-2001



Status	Count	
	Species	Habitats
Recovered	3	0
Signs of recovery	8	4
No change	81	19
In decline	47	5
Lost	16	0
Insufficient information	29	13

Biodiversity refers to the variety of life. A rich variety of species, habitats and ecosystems provides many of the essentials of life – water, food, clothing, medicines and relaxation.

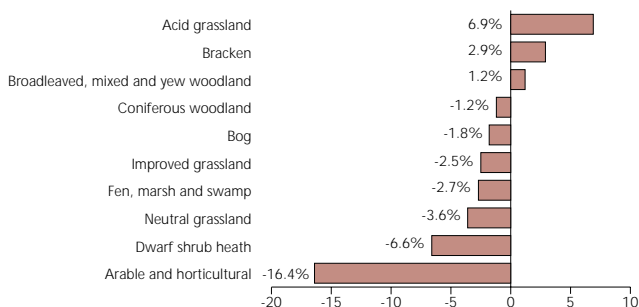
In 1992, the UN Convention on Biological Diversity recognised the need to protect biodiversity. The UK was one of the 150 countries to sign up to the convention, and the UK Biodiversity Action Plan (UKBAP) was published to develop strategies to protect biological diversity.<sup>2</sup> The Scottish Biodiversity Group (SBG) is responsible for implementing the objectives of the UKBAP in Scotland.

In Scotland, 184 species and 41 habitats are addressed by the UKBAP. Between 1996 and 2001, 92 (50%) of the species showed 'no change' or recovered to some degree, while 63 (34%) were 'in decline' or had been lost. All 16 species that are listed as 'lost' are believed to have had that status before the implementation of the UKBAP programme.<sup>3</sup> Figures for habitats indicate that just over half showed 'no change' or some signs of recovery. No habitats were lost, although 5 (12%) were declining.

SOURCE: SCOTTISH BIODIVERSITY GROUP

## Changes in Plant Diversity: 1990-1998

Percentage change in plant diversity



### Mean number of vascular<sup>4</sup> plant species recorded

	1990	1998	% change
<b>Per 1km square</b>	70.5	70.1	- 0.6
<b>Plots in acid grassland</b>	15.4	16.5	6.9*
<b>Plots in dwarf shrub heath</b>	14.4	13.4	- 6.6*

(\*statistically significant,  $P < 0.05$ )

Plant species diversity is one measure of botanical composition that can provide an indication of changes in habitat quality. Changes are often associated with land management and atmospheric pollution. Effects of climate change may become evident in the future.

The Countryside Survey 2000<sup>5</sup> reported changes between surveys in 1990 and 1998 of 193 1km sample squares. Plant diversity, in terms of the number of vascular plant species recorded, was estimated from plots placed within each square.

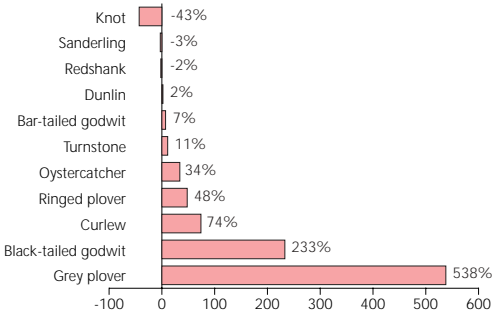
No overall change was detected in the mean number of plant species recorded per square (a decline of 0.6% was not statistically significant). There were no changes within most broad habitats, including the arable and horticultural broad habitat, which is subject to a high degree of year-on-year disturbance. Significant changes in plant diversity were observed only in acid grassland and dwarf shrub heath.

An estimated 6.9% increase in plant diversity in acid grassland was in part due to an increased abundance of plant species associated with less acid conditions. An estimated 6.6% decrease in the species richness of dwarf shrub heath was associated with a decline in the prevalence of stress-tolerant plant species associated with low-nutrient conditions. This was partly offset by an increase in competitor plant species, which tend to benefit from heavy grazing or nutrient enrichment.

SOURCE: COUNTRYSIDE SURVEY 2000, SCOTTISH NATURAL HERITAGE

## Status of Wintering Waders: 1969-1999

Percentage change in population between 1969-73 and 1995-99



### Species with at least 10% change in population

Species	% change	Species	% change
Grey plover	538	Oystercatcher	34
Black-tailed godwit	233	Turnstone	11
Curlew	74	Knot	-43
Ringed plover	48		

During the autumn and winter, Scotland's wetlands support important populations of breeding waders. Most waders are highly mobile, capable of responding rapidly to changes in the environment which might affect feeding or breeding behaviour. For example, weather conditions may affect count data for a particular species. Trends may therefore indicate a redistribution of populations rather than a decrease or increase.

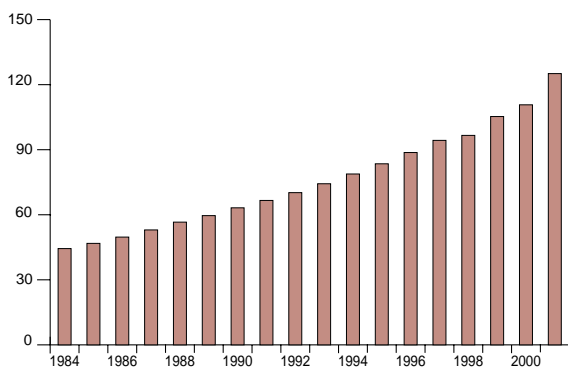
The Wetland Bird Survey<sup>6</sup> provides reliable population indices on 11 out of 18 wader species wintering in Scotland. Comparing the mean population during two five-year periods, 1969-1973 and 1995-1999, shows that six of the 11 species increased by at least 10%. The grey plover showed the biggest rise in population, increasing by 538% during the period. Only one species fell by over 10%. The knot population decreased by 43% between 1969-1973 and 1995-1999. Four of the species showed little change over the period.

The UK is bound by international laws to protect and conserve waders, and the wetlands on which they depend. These include the Ramsar Convention on Wetlands, the EC Birds Directive (79/409/EEC and amendments) and the EC Habitats Directive (92/43/EEC).

SOURCE: WETLAND BIRD SURVEY<sup>6</sup>

## Status of the Grey Seal: 1984-2001

Estimated population (thousands)<sup>7</sup>; aged one year and above



Estimated population<sup>7</sup> (thousands)

	1984	1990	1995	1999	2000	2001
<b>Seals aged one year and above</b>	44.4	63.2	83.5	105.3	110.7	125.1

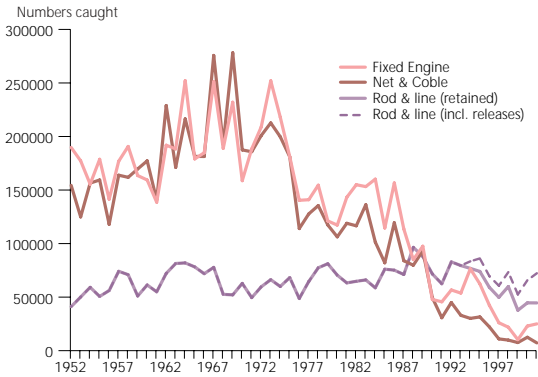
The Scottish coastline contains internationally important seal populations. An estimated 38% of the world population of grey seals, *Halichoerus grypus*, breeds in British waters<sup>8</sup>. The Scottish population of this species is of particular conservation importance, as over 90% of the UK's grey seals are found around Scotland.

At the start of the 2001 pupping season, there were an estimated 125,100 grey seals in the waters of Scotland and eastern England,<sup>7</sup> an increase of 180% since 1984. This has been achieved through an average population increase of approximately 6% per year. Since 1997, the rate of increase has slowed to 5.6% per year.<sup>8</sup>

The grey seal is protected under the Conservation of Seals Act 1970, which makes it an offence to take or kill any grey seal, except under licence in certain circumstances, between 1 September and 31 December each year. This coincides with the pupping season when the seals are at their most vulnerable. The grey seal also receives some protection from cruelty under the Wild Mammal (Protection) Act 1996 and is listed as a protected marine species in the EC Habitats Directive (92/43/EEC).

SOURCE: SEA MAMMAL RESEARCH UNIT

## Catches of Wild Salmon<sup>9</sup>: 1952-2001



Numbers caught (thousands)

Method <sup>10</sup>	1952	1960	1970	1980	1990	2001
Fixed engine	190	159	159	117	48	25
Net & coble	154	177	187	106	50	7
Rod & line <sup>11</sup>	41	61	63	71	72	73

The salmon fishing industry is a significant economic and leisure resource in rural Scotland. To protect this resource sustainable management practices are essential. Climate change, water pollution, predation and disease may affect populations. Yearly variations in weather, timing of runs and fishing effort can affect catch sizes. So, a difference in catch does not necessarily indicate a difference in the abundance of the stock that provides the catch.

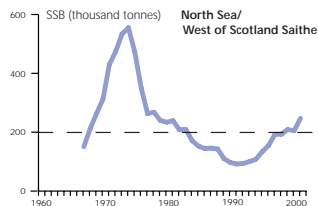
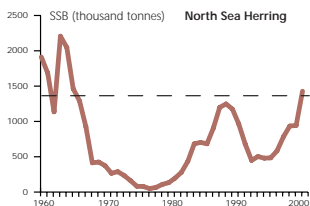
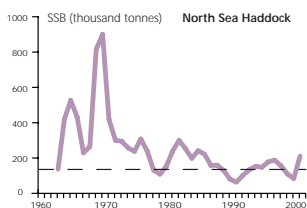
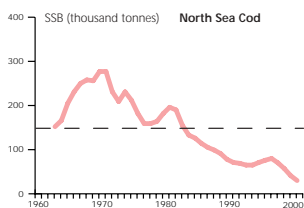
Catch sizes for the fixed engine and net & coble fisheries have fallen by 87% and 95% respectively since 1952. Catches rose during the 1950s and 1960s but have declined rapidly since the early 1970s. It should be noted that the fishing effort has declined at a similar rate, with effort for 2001 being less than 10% of that for 1952 for both fisheries.

Catches by rod & line have remained relatively steady over the period 1952-2001. Since 1994, salmon that have been caught and released by anglers have been reported separately. In 2001, 45,000 salmon were retained and 28,000 released. No figures for fishing effort for the rod & line fishery are available.

The Salmon Act 1986, as amended by the Salmon Conservation (Scotland) Act 2001, contains terms for the conservation and sustainable management of salmon fisheries in Scotland. For example, through provisions for setting weekly and annual close times and defining the fishing method that may be used.

SOURCE: FRESHWATER FISHERIES RESEARCH SERVICE<sup>12</sup>

## Major Commercial Fish Stocks: 1960s-2001



Estimated SSB and Bpa (thousand tonnes)

Stock <sup>13</sup>	1967	1980	1990	2000	2001	Bpa
NS Cod	250	182	78	41	30	150
NS Haddock	229	153	81	84	211	140
NS Herring	923	133	1,174	943	1,428	1,300
NS/WoS Saithe	151	234	97	205	247	200

The ecosystem of the seas around Scotland is affected by commercial fishing for many species. The status of fish stocks is monitored to estimate the spawning stock biomass (SSB) – the total weight of fish capable of spawning in any one year. The health of a stock is assessed by comparing the SSB with the 'safe biological limit' (Bpa). The International Council for the Exploration of the Seas provides advice on fishery management for many fish species.

A ban on herring fishing in the North Sea between 1977 and 1983 allowed the stock to recover from a collapse, caused largely by overfishing in the 1960s and 1970s. A decline in the early 1990s meant that further measures were introduced in 1996. The North Sea cod stock has been declining since the late 1960s. Despite regulatory measures, fishing pressure on cod has been high since the early 1980s and the SSB remains low. The increase in the North Sea haddock SSB in 2001 is mainly due to the exceptionally strong 1999 year class. Subsequent year classes are below average and it is expected that the SSB will decline to below Bpa in the short term at current fishing mortality rates. After a 20-year period of decline, the SSB of North Sea/ West of Scotland saithe has been increasing since the early 1990s.

SOURCE: FISHERIES RESEARCH SERVICES, ICES<sup>14</sup>

### General

- 1) Estimates as at 30 June each year.
- 2) General Register Office for Scotland (2002). Population Projections, Scotland (2001 based).
- 3) Government Actuary's Department. Population projections.
- 4) GDP estimates are based on output and are at constant 1995 prices. Excludes continental shelf. Seasonally adjusted.
- 5) Net amount of electricity accounted for by transmission and distribution losses, pumped storage and own use, and major power producers purchases from other generators.
- 6) Figures for hydro include the net electricity generated by pumped storage.
- 7) Includes landfill gas and wind power.
- 8) Department for Transport has revised its estimates of the total volume of traffic, in Scotland and in other parts of Great Britain, for 1993 and later years.
- 9) Scottish Executive (2003). Scottish Transport Statistics No. 22.

### Public Attitudes

- 1) Scottish Executive (2002). Public Attitudes to the Environment in Scotland 2002. Research Findings No. 24/2002.
- 2) Scottish Office (1991). Public Attitudes to the Environment in Scotland. Central Research Unit.
- 3) World Commission on Environment and Development (1987). Our Common Future.
- 4) Respondents were asked whether they agreed that there was a need for most people in Scotland to change their way of life, and whether they themselves needed to change their way of life.
- 5) Scottish Executive (2002). Meeting the Needs ... Priorities, Actions and Targets for Sustainable Development in Scotland.

## Global Atmosphere

- 1) IPCC Third Assessment: Climate Change 2001. A Report of the Intergovernmental Panel on Climate Change.
- 2) UK Climate Impacts Programme (2002). Climate Change Scenarios for the United Kingdom (UKCIP02).
- 3) Excluding 1930.
- 4) For period 2000-2002 only.
- 5) Jones, P. & Conway, D. (1997). Precipitation in the British Isles: An analysis of area-average data updated to 1995. *J. Climatology* 17:427.
- 6) Emissions are weighted by Global Warming Potential (GWP). GWP accounts for the potency of the gas as well as the amount emitted. For example, PFCs and SF<sub>6</sub> are released in small quantities, but are long-lived and therefore highly potent. The estimated uncertainty in GWP for 2000 is  $\pm 21\%$ .
- 7) Hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
- 8) The 2000 estimates are subject to uncertainties of: CO<sub>2</sub> =  $\pm 11\%$ , methane =  $\pm 19\%$ , HFC =  $\pm 25\%$ , PFC =  $\pm 19\%$ , SF<sub>6</sub> =  $\pm 13\%$ . For more details see Salway *et al* (2003).
- 9) Salway, A.G., Murrells, T.P., Milne, R. & Hidri, S. (2003). Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2000. Netcen, AEA Technology.
- 10) Industrial processes and waste incineration.
- 11) Emissions from military, off-shore industry, aviation and shipping are not included in the Scottish inventory.
- 12) Department for Environment, Food and Rural Affairs. Environmental Statistics website.
- 13) Stratospheric ozone should not be confused with tropospheric (ground level) ozone.

## Air Quality

- 1) PM<sub>10</sub> concentrations are measured at five automatic monitoring sites: Aberdeen, Edinburgh, Grangemouth and two sites in Glasgow.
- 2) Department for Environment, Food and Rural Affairs Environmental Statistics website.

- 3) Department for Environment, Food and Rural Affairs, Scottish Executive, Welsh Assembly Government & DOE Northern Ireland (2003). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum.
- 4) Concentrations of nitrogen oxides are measured at eight automatic monitoring sites: Aberdeen, Dumfries, Edinburgh, Grangemouth, Inverness and three sites in Glasgow.
- 5) Carbon monoxide concentrations are measured at seven automatic monitoring sites: Aberdeen, Dumfries, Edinburgh, Inverness and three sites in Glasgow.
- 6) Ozone concentrations are measured at four sites: Eskdalemuir, Strath Vaich, Edinburgh and Glasgow.
- 7) Objective not currently included in the Air Quality Regulations because of the transboundary nature of ozone.
- 8) No 1965 figure for Edinburgh.
- 9) Sulphur dioxide concentrations are measured at four automatic monitoring sites: Aberdeen, Edinburgh, Glasgow and Grangemouth.
- 10) Large combustion plants have a rated thermal output of over 50 megawatts.
- 11) Smith, *et al.* (unpublished) Sulphur deposition in Scotland, in Report for the Scottish Office under EVF/1/13 CRU 95/96.

## Water

- 1) Scottish Executive Water Services Unit (2002). Public Water Supplies in Scotland: Water Resources Survey 2001-2002.
- 2) The Water Quality 1000 index covers regulatory compliance with 10 key drinking water parameters – total coliforms, faecal coliforms, colour, turbidity, pH, aluminium, iron, manganese, lead and total trihalomethanes. The index is determined by summing the percentage compliance for each parameter.
- 3) Scottish Executive Water Services Unit (2001). Drinking Water Quality in Scotland 2000.

- 4) *Poor and seriously polluted* categories should be unaffected by the length of river classified each year. Any changes to these figures generally reflect a change in quality. Changes to the length of rivers classified as *excellent, good and fair* are mainly due to the overall increase in length classified, so figures are not included.
- 5) Scottish Environment Protection Agency (2002). SEPA Annual Report 2001-2002.
- 6) Average of all harmonised monitoring site means in the SEPA area, each being given equal weight, irrespective of the number of samples taken.
- 7) In Aberdeen, Moray, Banff and Buchan, Strathmore, Fife, Lothians and Borders, and Lower Nithsdale.
- 8) Under the Designation of Nitrate Vulnerable Zones (Scotland) Regulations 2000 and EC Nitrates Directive (91/676/EEC) Annex 1A(3).
- 9) Matter other than sewage or trade effluent.
- 10) Scottish Environment Protection Agency (2003). Corporate Plan April 2003-March 2004.
- 11) In 1999, a further 37 bathing waters were added to the 23 already identified. Two of these were inland bathing waters that are subject to different parameters. They have been removed from the data presented here.
- 12) In 1999, 2000, 2001 and 2002, the percentage compliance of the 23 original bathing waters with the mandatory standards was 87%, 83%, 78% and 96% respectively.

### Radioactivity

- 1) Radon and gamma values are specific to Scotland. Other values are assumed to be the same as the UK average as published in NRPB's 1999 Review.
- 2) 'Others' includes fallout, disposals, occupational and consumer products (smoke alarms, luminous watches, etc.).
- 3) 1996-2001 figures are not strictly comparable with previous years, although still represent average concentrations in milk in Scotland.
- 4) Strontium-90 was not produced at the Chernobyl nuclear power reactor.

## Waste

- 1) Figures for 1995 and 1996 are not available.
- 2) Figures may not sum to total due to rounding.
- 3) Scottish Environment Protection Agency (1999). National Waste Strategy: Scotland.
- 4) Assuming a derogation to postpone the targets for 4 years is used.
- 5) Scottish Office Statistical Bulletin Env/1996/5 (1996). Waste Collection, Disposal and Regulation Statistics 1994.
- 6) Scottish Environment Protection Agency (2002). Waste Data Digest 2002.
- 7) Aberdeenshire, Angus, Argyll & Bute, Dumfries & Galloway, East Ayrshire, Eilean Siar, Highland, Moray, Orkney, Perth & Kinross, Scottish Borders, Shetland, South Ayrshire and Stirling are classed as rural councils. The remaining councils are classed as urban.
- 8) Scottish Environment Protection Agency (2003). National Waste Plan.
- 9) Accounts Commission for Scotland (2003). Performance Indicators 2001-2002: Environmental and Regulatory Services.
- 10) Accounts Commission for Scotland (2003). Performance Indicators 2001-2002: Compendium.
- 11) The Scottish Household Survey is a continuous cross-sectional survey based on a sample of the population in private residences in Scotland.

## Land

- 1) The 1990 and 1998 surveys are not directly comparable. The change in habitat is determined after the 1990 figures have been adjusted to account for the differences in the surveys.
- 2) UK Biodiversity Steering Group (1995). Biodiversity: The UK Steering Group Report. HMSO.
- 3) Haines-Young, R.H. *et al.* (2000). Accounting for nature: assessing habitats in the UK countryside. Department of the Environment, Transport and the Regions.
- 4) Scottish Natural Heritage (2002). Facts and Figures 2001-2002.

- 5) Figures may not sum to total due to rounding.
- 6) Figures from SEERAD payments to the one-year and five-year set-aside schemes and the Arable Area Payment Scheme.
- 7) Excludes Orkney, Shetland and the Western Isles.
- 8) Total quantity of nutrient used (kg) to the total extent of crop area (ha).
- 9) Department for Environment, Food and Rural Affairs, Fertiliser Manufacturers Association and Scottish Executive (2003). The British Survey of Fertiliser Practice 2001. The BSFP Authority.
- 10) Woodland is defined as land under stands of trees with a canopy cover of at least 20%, or having the potential to achieve this, including integral open space, and including felled areas that are awaiting restocking.
- 11) Forestry Commission (2002). Forestry Statistics 2002.

## Wildlife

- 1) Figures do not sum to 100% due to rounding.
- 2) Department of the Environment (1994). Biodiversity: the UK Action Plan. HMSO.
- 3) Scottish Executive (2002). Biodiversity in Scotland: Progress Report. SE Central Research Unit.
- 4) Vascular plants (sometimes referred to as higher plants) have veins to transport fluids throughout the plant. These include ferns, flowering plants, shrubs and trees.
- 5) Haines-Young, R.H. *et al.* (2000). Accounting for nature: Assessing habitats in the UK countryside. DETR.
- 6) Musgrove, A.J., Pollitt, M.S., Hall, C., Hearn, R.D., Holloway, S.J., Marshall, P.E., Robinson, J.A. & Cranswick, P. A. (2001). The Wetland Bird Survey 1999-2000: Wildfowl and Wader Counts. BTO/WWT/RSPB/JNCC, Slimbridge.
- 7) Figures are from all regularly monitored sites in Scotland. They include sites on the east coast of England with approximately 6,000 seals, which are not considered ecologically separate communities. They do not include Scottish sites that are not surveyed regularly, which account for roughly 9,000 seals.

- 8) Special Committee on Seals: Scientific Advice on Matters Related to the Management of Seal Populations 2002. Natural Environment Research Council.
- 9) Includes grilse (salmon which have matured, or are about to mature, after one winter at sea).
- 10) Fixed engine fisheries operate in coastal areas. Net & coble fisheries are generally restricted to estuaries and the lower reaches of rivers. Rod & line fisheries cover recreational angling within river systems.
- 11) Since 1994, numbers of fish reported as caught and released by anglers have been reported separately. Prior to this, only numbers caught and retained are available.
- 12) Statistical Bulletin Fisheries Series No. Fis/2002/1 (2002). Scottish Salmon and Sea Trout Catches, 2001. Scottish Executive Environment and Rural Affairs Department.
- 13) Estimates for cod, haddock and herring are for the North Sea stock. Those for saithe are for the North Sea and west of Scotland stock.
- 14) International Council for the Exploration of the Seas Research Report No. 255 (2002). Report of the ICES Advisory Committee on Fishery Management.

Throughout this publication, a '-' represents figures that are not available.

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