Answers to case study questions

Topic 1

1.01.01

1 Consider whether the use of social media is as important as the physical presence of protesters.

2 Some people are willing to risk their lives for the environment; think about their EVSs. If they take these risks, should we be prepared to accept some damage to property?

3 Use the internet, social media or reference books to help you. It is important to put forward your point of view and argue your case logically.

1.01.02

1 Australia has an EVS that views whales as important and worthy of conservation (ecocentric). Whaling nations argue that they have always hunted whales for food (anthropocentric).

2 History, culture, education and media influence an EVS.

3 Whales do not belong to any nation or territory but range freely in the oceans. Without international cooperation, protecting them would be impossible.

4 In your discussions, consider factors such as how people are exposed to information about whaling. Is it in school, in the media or from their daily experiences?

1.02.01

1 Inputs are light and heat (energy only).

2 The people inside had insufficient oxygen to sustain them and were unable to produce sufficient food.

3 You should discover that Biosphere 2 is used for education and smaller research projects on the water cycle, soil studies and climate change.

1.02.02

1 Suggestions might include: computer technology that can control the application of fertilisers or the planting of seeds in selected locations to maximise their benefit; medical treatment for animals, for example vaccinations, use of growth hormones (controversial), and any other suitable examples.

2 In monocultures, pests can devastate a crop if they become established, because there are no barriers to prevent them; there is damage to the natural environmental system, which may lead to the exclusion of useful natural predators; when petroleum products become expensive, the price of food will also rise (or other suitable examples).

3 Inputs 100 years ago were lower, usually involving manual labour, use of animals such as horses and oxen, and natural fertilisers such as manure. Outputs were also lower due to lack of pesticides, antibiotics and machinery. Waste was also higher for the same reasons.

1.03.01

1 As the numbers of a predator increase, so does the pressure on the population of a prey species. This means the amount of food available to the predator decreases and its numbers fall. The consequence is that prey numbers increase and feed back to the predator population, which can also increase.

2 If the numbers of prey species fell too low, the predators might starve and there would be insufficient numbers left to breed and replenish the population. In an extreme case, the predator would become extinct in the area or move away to find new sources of food. Human interference could also upset the feedback in the system and prevent it from returning to equilibrium (*or other suitable suggestions*).

3 Possible adaptations include speed, acute hearing or sight, and toxin production for predators, and camouflage, speed, senses, and immunity to a predator's toxins for prey.

1.04.01

1 Fishing downstream has been affected; erosion has been greater than anticipated; a major earthquake has been linked to the construction project; people downstream have been affected by pollution. The EIA did not accurately predict these consequences.

2 Costs: social and environmental displacement of ecosystems and human societies, erosion, earthquakes, seismic activities (possibly); loss of biodiversity, arable land, historic sites; local people and those downstream affected by pollution; drought in Shanghai.

Benefits: large-scale production of power for China's industrial development, hydroelectric power produces cleaner energy, increasing wealth of citizens and the country. EIA predicted some of these factors but could not predict the enormous need for ecological protection and pollution control or the droughts and earthquakes that have occurred.

3 Strengths: an EIA can ensure that environmental impacts are considered at some point in the decision-making process, they can make sure that projects conform to appropriate standards, and can protect human health and safety.

Weaknesses: decision-making is done at a level above where the EIA is carried out, and so it is difficult to assess how the EIA has affected the decision; valued resources may not be protected, and irreversible changes can take place even with an EIA.

1.05.01

1 Oil is not biodegradable, so has chronic long-term effects. When people change the oil in their cars, they are also likely to change the filters, so targeting both together is a useful strategy.

2 Small businesses, garages and repair shops, individuals who are environmentally aware.

3 Start by looking for initiatives by manufacturers, and laws requiring reduction in packaging and recycling of waste.

1.05.02

1 Because DDT accumulates in a food chain. Plants absorb a small amount of DDT; as they are eaten by consumers, the consumers take in and accumulate more DDT and so, when eagles (top consumers) feed on numbers of fish, they accumulate even more DDT and their bodies contain toxic amounts.

2 Because there was no firm scientific evidence at that time.

3 These birds are also carnivores and also consume fish, which are likely to contain accumulations of the poison.

Topic 2

2.01.01

1 Topography, salinity and temperature are the most important abiotic factors, but others will be influential.

2 The habitat of the barnacle is the physical environment in which it lives – an exposed rocky shore where is it covered and uncovered by the tide. A niche, on the other hand, is not just the *Chthamalus* habitat but also the ways in which it interacts with *Balanus* and the physical environment.

3 Human interference; habitat destruction, for example as the result of a severe storm; introduction of another invasive species; or any other suitable example.

2.01.02

1 A J-curve showing exponential growth.

2 There were no natural predators and food was plentiful, so the population continued to expand.

3 The invasive species have characteristics that make them more successful in their new habitats than the indigenous species. As a result, native species are outcompeted and die.

2.02.01

1 Caterpillar populations increased because their natural predator, the wasp, was killed by DDT. More caterpillars ate more of the roofs and caused them to collapse.

2 DDT accumulated in the food chain: insect → gecko → cats. Hence the amount consumed by the cats was fatal.

3 Rats would have been killed and eaten by the gecko-eating cats, so as cats died, rat numbers increased. Rats do not eat geckos, so would not have high levels of DDT in their bodies. The new cats helped the villagers by eating the rats.

2.02.02

1 Possible answers: In this case humans were badly affected by the poison, so Minamata Bay is well known and quoted by environmental campaigners; people now understand how dangerous mercury (and other heavy metals) are to the natural world; the location of factories and their outfalls is probably considered more carefully in most countries now (*or other suitable examples*).

2 It takes time for the poison to accumulate to dangerous levels and cause neurological problems; the economy of the region depended on the factory, so people were reluctant to blame the factory; there was limited understanding at the time about the effects of cumulative poisons.

3 One interesting area is the use of microorganisms in bioremediation, but there are other aspects too.

2.03.01

1 Herbivores feed on plants, and these contain a lot of indigestible material such as cellulose, which is lost in faeces. The food of carnivores is more nutritious and less of the food taken in is wasted.

2 Herbivores tend to stand still for long periods as they feed; they may also sit and digest their food. Carnivores on the other hand must use energy to capture and kill their prey, and this means there are greater respiratory losses.

3 Less energy is used to maintain body temperature, so less respiration occurs and heat loss from respiration is lower. Aquatic animals do not have large skeletons, so energy is not needed to build them; water supports the body of a jellyfish.

2.03.02

1 Natural cycling of carbon and nitrogen is interrupted because leaf litter and dead plants are not broken down by decomposers; ash contains nutrients, but these are rapidly

used up by growing crops, and since the crops are harvested the nutrients are not replaced.

2 Indigenous communities are likely to have lived in (for example) a forest region for many generations. They use a cycle of cultivation so that the first plot used to grow crops is not reused for a long time. Thus it can recover its fertility between uses.

3 This is positive feedback.

2.04.01

1 Graph showing exponential rise followed by a levelling off.

2 **a** Spiders – carried on the wind or on the bodies of birds.

b Mosses – spores carried on the tides from Iceland.

c Plants – seeds carried on the sea or in the waste of birds or on their bodies.

3 Seabirds carry organisms, materials (such as nesting material), and also deposit waste which acts as fertiliser for the developing soil. If they nest, they also leave decaying material after the breeding season and disturb the terrain with their activities, mixing up soil and nutrients.

4 Answers should suggest an increase in the number of species and a general increase in their size and diversity.

2.05.01

1 The calculations show that, even though there are fewer organisms in pond 2, the numbers of individuals of each species are more even than in pond 1 and the pond is not dominated by any one species.

2 More individual organisms were collected in pond 1, but two species were more dominant than the other. This pond is less diverse than pond 2.

3 Netting organisms on the surface and at different depths in the ponds, using the same type of net and method of sampling in each case.

Topic 3

3.01.01

1 Species richness (or number of species), and evenness.

2 An increase in either richness or evenness leads to an increase in diversity. More species mean higher diversity, but if species are not evenly distributed, diversity falls.

3 Species richness of plants is positively correlated with net primary productivity (NPP), and both are greater in tropical forests than temperate forests. You may also like to research the relationship between species richness and latitude.

3.02.01

1 The land was drier and open grassland developed.

2 In open grassland there was more food, but the presence of grazing animals attracted predators. The horses evolved the ability to eat grass and also to run faster.

3 This research project (at Copenhagen University) will not be complete until 2016, but already it seems that Przewalski's horse is more closely related to modern horses than had been thought, and the two species diverged around 50 000 years ago.

3.03.01

1 Legislation on Mauritius might have helped protect the birds, but many people would argue that sailors required fresh supplies of food in the days before preservation and refrigeration of foods. Protection of certain regions of the island for dodo breeding, where hunting was banned, would probably have saved them. The introduction of predators and poor weather could not have been anticipated or prevented.

2 At the time of the dodo, photography was not available to record the birds. Drawings were made and specimens collected which may have been damaged by the time they reached scientists. As the bird was so unusual, it was difficult for predictions to be made about it from other specimens.

3 Possible suggestions: other flightless birds did not live on small islands, they might not have been good to eat, they were not passive like the dodo, they had not suffered habitat loss.

3.03.02

1 A longer life means that adult fish are more likely to accumulate toxic levels of persistent pesticides; long-lived individuals may survive in isolated areas where there are no potential mates and where access by new fish is impossible; long-lived species like this do not spawn every year, so reproductive success is reduced.

2 Civil disruption such as war reduces availability of food and leads to more poaching and overfishing; inability of governments to enforce laws protecting the fish; disagreements about conservation matters between the different countries through which rivers flow.

3 Possible answers might include the following. Similarities – both fish are used for food, so have been put under pressure by human population increase; both have suffered habitat loss in recent decades partly due to human interference with waterways. Differences – eels are not long lived whereas sturgeon are; eels migrate and live in both fresh and sea water; eels return to the same spawning grounds each year.

3.03.03

1 The development of fast vehicles that could travel across the sands made the animals easier to chase down. High-powered, long-range weapons made them easy to kill.

2 Zoos and nature parks that keep small herds of animals provide a wider gene pool than remains in a very small wild population. Gene registers enable zoos to collaborate with other institutions and make sure that a wide variety of genes is present in the animals that are chosen to breed; females can be nurtured as they give birth so that larger numbers of young survive.

3 Students might consider jerboas (not threatened), desert tortoise (vulnerable), addax (critically endangered), slender-horned gazelle (endangered), Saharan cheetah (critically endangered). Many other options are possible.

3.04.01

1 No, Paine's experiment showed that the food web contained few predators but that these are crucial to the stability of the system.

2 The keystone species is not the dominant (most abundant) species in this food web. This is because it is a top predator; there are always fewer top predators than other trophic levels in a food web (see Topic 2).

3 To be sure that the results were valid and not simply due to an effect in one part of the world.

3.04.02

1 Laws must be enacted and enforced; local people must engage with the conservation programme (*or other suitable suggestions*).

2 They are charismatic species that encourage funding and visitors, which then support the conservation of other species present.

3 Ecotourism is important for funding, education and outreach. Local people, governments and tourists all benefit economically.

Topic 4

4.01.01

1 The two catchments lie in the upland massif of mid-Wales and are characterised by rolling hills. The geology, soils, topography and precipitation are similar in both river basins. The geology comprises slates, mudstones and sandstone rocks, which are generally classified as impervious. The climate is wet, with up to 2500 mm of precipitation falling on the highest ground. Although the sources of both rivers are close together, the land use in the two river basins varies significantly. The River Wye flows over moors and grassland, while the River Severn flows through an area of coniferous forest.

2 The peak flow in the River Severn (about 70 m^3s^{-1}) is significantly less than that of the River Wye (about 95 m^3s^{-1}). This is almost entirely due to the much higher rate of interception in the upper part of the drainage basin of the River Severn, because geology and precipitation are similar in both basins. After peak flow occurs, discharge in the River Severn falls off more slowly due to less rapid runoff.

3 A new urban area would reduce infiltration and increase surface runoff. Thus, the rising and falling limbs of the hydrograph for the River Severn would both become steeper.

4.02.01

1 Seventy per cent of California's runoff originates in the northern one-third of the state, but 80 per cent of the demand for water is in the southern two-thirds.

2 Northern California; the Sierra Nevada mountains; the Colorado River.

3 Although the river was originally committed to delivering 20.35 trillion litres every year, its annual flow has averaged only 17.25 trillion litres since 1930. Also, demand has escalated with population growth and rising living standards. The river now sustains around 25 million people and 820 000 ha of irrigated farmland in the USA and Mexico.

4.03.01

1 The fishery had been overfished to such an extent that there were no adult fish left to reproduce. No monitoring was taking place to assess the problem. Fishermen thought that, because the fishing grounds had always been so rich, they would always be so.

2 Factory ships are large and take huge quantities of fish; they are fitted with sonar to locate shoals of fish; they may take species indiscriminately, so young fish that are not required are killed and do not replenish the population. Large drag nets may damage the ocean floor and lead to more habitat loss.

3 Maximum sustainable yield is the largest yield or catch of fish that can be taken from the stock in the oceans without endangering the population.

4.04.01

1 Sewage is the major source of nitrate and phosphate pollutants which were causing eutrophication in the lake.

2 Biomanipulation removed the species (tilapia) that were feeding on zooplankton which would otherwise have reduced the quantity of phytoplankton (algae) in the

lake. As a result, the zooplankton numbers increased and zooplankton were able to restore equilibrium to the lake.

3 Healthier environment for nearby residents; potential use of the lake for recreation; potential use of the lake for fishing tilapia under controlled conditions.

Topic 5

5.01.01

1 For example: soil constraints; mountainous landscapes; land degradation; urban encroachment.

2 USA, India, Russia, China.

3 China has about 20 per cent of the world's population but only 7 per cent of its arable farmland, and it is becoming an increasing net importer of food. The current per-capita cultivated farmland in China is about 0.092 hectares, which is only about 40 per cent of the global average.

5.02.01

1 In the western provinces of Alberta, Saskatchewan and Alberta.

2 Soil degradation poses a considerable challenge. The loss of habitat for wild native species and the loss of such biodiversity in the long term has greatly concerned scientists. Another issue receiving much attention is the high level of fertiliser use and its environmental impact, particularly in terms of greenhouse gas emissions. Canada has one of the highest per-capita usages in the world of nitrogenous fertiliser, an issue that environmental groups have protested about. The first GM crops were planted in the prairies in the mid-1990s. Environmental groups such as Greenpeace have been constant critics pointing to a mounting range of evidence about the adverse impact of GM production.

3 Large-scale farming of this nature has had a significant impact on the environment. Soil degradation is a major issue, as is the loss of biodiversity. The almost total dominance of commercial farming in the prairies has left little in terms of habitat for wild native species. There is concern about the loss of such biodiversity in the long term. Another issue receiving much attention is the high level of fertiliser use and its environmental impact, particularly in terms of greenhouse gas emissions. The use of GM crops on the prairies since the mid-1990s has been a constant issue of criticism from environmental groups.

5.02.02

1 The rice is grown on very small plots of land using a very high input of labour. Rice cultivation by small farmers is sometimes referred to as 'pre-modern intensive farming' because of the traditional techniques used, in contrast to intensive farming systems in MEDCs, such as market gardening, which are very capital intensive.

2 The use of higher-yielding varieties of rice in recent decades has increased production significantly. The average padi rice yield in India increased from 1.5 tonnes per hectare in 1960 to over 3.5 tonnes per hectare in 2013.

3 Rice cultivation is a significant source of atmospheric methane. Methane is 20 times more potent as a greenhouse gas than carbon dioxide. The high water requirement of rice cultivation is another major issue.

5.03.01

1 Traditional soil-management strategies have included crop-fallow rotation, ripping and strip farming. However, a number of changes have been in evidence over the last decade or so. Traditional monoculture cereal cropping systems that rely on frequent summer-fallowing and use of mechanical tillage for weed control on fallow areas and for seedbed preparation are being replaced by extended and diversified crop rotations together with the use of conservation tillage (minimum- and zero-tillage) practices. Including oilseed and pulse crops in rotations that have traditionally been cereal monoculture has reduced the frequency of summer fallow.

2 The traditional practice of turning the soil before planting a new crop is a leading cause of soil degradation. An alternative is no-till farming, which minimises soil disruption. Here, famers leave crop residue on the fields after harvest, where it acts as a mulch to protect the soil and provide nutrients. To sow seeds, farmers use seeders that penetrate through the residue to the undisturbed soil below.

3 The expertise in such techniques may not be available and the cost of implementing such measures might also be a major obstacle.

5.03.02

1 Among the problems faced by the farmers of Arumeru are steep slopes, erosion hazards, variable soils and low and unreliable rainfall. Soil fertility and nutrient status are generally precarious after a significant period of soil degradation, much of it associated with population pressure.

2 The PLEC project has attempted to diversify the soil-management methods used by farmers in Arumeru to raise soil productivity and enhance soil conservation. The three basic soil-conservation principles of the project are: minimum soil disturbance or, if possible, no tillage at all; soil cover, permanent if possible; crop rotation. By following

these principles the objective is to enhance soil fertility by improving water retention, increasing soil organic matter and reducing soil degradation.

3 Farmers have responded to their soil problems with a mixture of management practices that reflect the resources they have available, traditional knowledge and the awareness of new techniques provided by PLEC. While conservation agricultural practices in Arumeru are still at a relatively early stage, the PLEC project has concluded that there has been enough evidence of successful implementation to undertake similar work in other areas.

Topic 6

6.01.01

1 **a** Albedo: the proportion of radiation that is reflected by a surface.

b Relative humidity: the amount of water vapour present in air, expressed as a percentage of the amount needed for saturation at the same temperature.

2 Clouds reflect and absorb a significant amount of incoming solar radiation. The overall albedo of the Earth is about 30 per cent. This means that 30 per cent of incoming solar radiation is reflected back into space. It has been estimated that, if all clouds were removed from the atmosphere, global albedo would fall to around 15 per cent. Thus, global cloud cover has a clear overall cooling effect on the planet.

3 Clouds form when air rises in the atmosphere. The molecules in rising air gradually expand, because air pressure decreases with altitude. As the air molecules move further apart in the process of expansion, energy is used up and the air cools. As air cools, its relative humidity increases. If cooling is sufficient for the relative humidity to reach 100 per cent, the air is said to be saturated and the process of condensation begins. Condensation produces water droplets and/or ice crystals, which form clouds. The temperature at which saturation occurs in a parcel of rising air is known as the dew-point temperature. Thus the base of a cloud is formed at the dew-point temperature. The top of a cloud marks the level in the atmosphere where the rising air is no longer warmer than the air around it, having cooled to the temperature of its surroundings.

6.02.01

1 The preconditions for the hole develop in late winter when polar stratospheric clouds absorb nitric acid/nitrogen oxides that would help to slow ozone loss. The formation of the ozone hole occurs in early spring as chlorine that has accumulated in the winter is released. This reacts with sunlight and destroys ozone. With nitrous oxides absent, ozone depletion is rapid. Warming in the spring and early summer brings about the breakdown of the ozone hole.

2 The ozone hole in 2010 was considerably smaller than it was in 1998. In 1998 it reached a maximum of almost 27 million km^2. In contrast, in 2010 its maximum extent was approximately 20 million km^2.

3 Chile and New Zealand.

6.03.01

1 There may be debate about which pollutant or combination of pollutants should be used to assess the degree of pollution in each city, as rank order can vary according to the measure(s) used. The number and location of monitoring stations and the time(s) of year that samples are taken may also affect results. In some cities the variations in levels of pollution are much greater than in others. City governments are aware that a reputation for high levels of pollution might deter tourism and business investment.

2 Transport is the main source of $PM_{2.5}$, NO_x and VOC emissions. It is by far the largest source of NO_x, at 67 per cent, and VOC, at 63 per cent. In contrast, transport is a minor source of SO_2 emissions. Road dust is the main source of PM_{10} emissions, and this is of course linked to the volume of road traffic. Power plants are responsible for over half of SO_2 emissions and almost 30 per cent of CO_2 emissions. Diesel generator sets are the second largest source of NO_x emissions (17 per cent).

3 The relocation of some factories to the outskirts of the city temporarily lowered pollution, but industry surrounding the city remains a significant source of pollution. Likewise, the benefits of the switch to compressed natural gas-based vehicles about a decade ago has diminished with the huge recent increase in traffic levels.

Investment in public transport has been slow to develop in Delhi compared with other cities of a comparable size. The Delhi Metro Rail only opened in December 2002, with an 8.3 km rail line, and has since been extended to 190 km with the completion of phase 2 in 2011. Construction of phase 3 is now underway, to add a further 103 km. Another significant development has been the Delhi bus rapid transit, which opened along a 5.6 km initial corridor in 2008.

Shutting coal power plants, promoting motor-less transport, and strict penalties for those violating pollution control norms are among the suggestions that the government is looking at to improve the air quality in the city over the next five years.

In 2014, the Indian environment ministry launched a national air quality index that will rank 66 Indian cities. It will give real-time information on air quality to put pressure on local authorities to take concrete steps to

reduce pollution. The index will describe associated health risks in a colour-coded manner that can be understood by everyone. It is likely that this measure will significantly increase public awareness of the problem.

6.04.01

1 The Pearl River delta region, an area the size of Belgium, is located in south-east China. The Pearl River drains into the South China Sea. Hong Kong is located at the eastern extent of the delta, with Macau situated at the western entrance.

2 The high concentration of factories and power stations and the growing number of vehicles in the province is the source of the problem. The rapid increase in the number of motor vehicles has been of particular concern in recent years. Apart from increasing emissions from vehicles: a few cities in Guangdong have been burning more coal to produce power, compensating for a decline in power transmission from western China; the persistence of acid rain in Shaoguan and Qingyuan results mainly from the various polluting industries, such as cement and ceramics, which have moved into these two cities in recent years.

3 Guangdong has formulated and issued a series of measures to combat regional acid deposition and other forms of air pollution. These measures include: reducing reliance on fossil-fuel power plants and reducing the sulfur content in fuels; forbidding new cement plants, ceramics factories and glassworks; installing particulate matter control devices for cement plants and industrial boilers; upgrading air pollutant emission standards for boilers; upgrading motor vehicle emission standards; encouraging 'green' public transportation.

Topic 7

7.01.01

1 China's energy mix is dominated by coal, which accounted for 69 per cent of total energy consumption in 2011. In second place was oil, accounting for 18 per cent. The remaining contributors to Chinese energy consumption were: hydroelectric power (6 per cent), natural gas (4 per cent), nuclear (1 per cent), other renewables (1 per cent).

2 China became a net importer of oil in the mid-1990s. Since then the gap between consumption and production has steadily widened. China now consumes more than twice the amount of oil it produces.

3 China is developing a strategic petroleum reserve due to: its concerns about energy security; its increasing reliance on oil imports; and to protect itself to a certain extent from fluctuations in the global oil price, which can arise for a variety of reasons. The plan is for China to build, in three phases, facilities that can hold 500 million barrels of crude oil by 2020. This will be equivalent to about 90 days' supply.

7.01.02

1 The three fossil fuels together contributed 87 per cent of UK primary energy consumption in 2011. Natural gas was the single most important source of energy (38 per cent), followed by oil (33 per cent) and coal (16 per cent). The remaining contributors to energy consumption were nuclear (8 per cent), bioenergy and waste (4 per cent), and wind and hydroelectric power (1 per cent).

2 The energy mix of the UK has changed significantly in the past due to: changes in resource availability; technological progress; the relative cost of different sources of energy; consumer behaviour.

3 Dependency on imported energy has risen as: UK production of oil and gas in the North Sea has fallen rapidly; domestic coal production has continued its long-term decline; some nuclear power stations have closed, having reached the end of their productive lives, with others due for closure in the next decade.

7.02.01

1 For example: the mean monthly temperature is below 1 °C over the whole country between November and March; late spring and early autumn frosts leave a short growing season of 80–100 days in the north and 120–140 days in the south; the average annual precipitation is only 251 mm, ranging from 400 mm in the north to less than 100 mm in the Gobi Desert. In comparison, London's average annual precipitation is 580 mm.

2 The increase in average temperature of 2.1 °C assessed by Mongolian meteorologists and 0.7 °C by international estimates are both above the average global increase during this period. During the last ten years of the timeline, above-average precipitation was recorded for only one year. This is of great concern in a country that has large areas of desert and semi-desert. In general, winter precipitation is increasing and summer precipitation is decreasing. As most of Mongolia's precipitation falls during the summer, this trend is disturbing. The occurrence of droughts is increasing.

3 Overgrazing, deforestation, soil erosion, desertification.

7.03.01

1 Seven per cent.

2 The loss of many industries, particularly heavy industries to NICs; improvements in energy efficiency in industrial processes.

3 Energy use in the transport sector increased by 50 per cent between 1970 and 2012 with the steady rise in the number of vehicles on the UK's roads. In 1970, the number of cars on the country's roads was 10 million compared with more than 27 million today.

Topic 8

8.01.01

1 1979.

2 China's total fertility rate has fallen from 4.77 births per woman in the 1970s, just before the one-child policy was introduced, to 1.64 in 2011.

3 The policy has had a considerable impact on the sex ratio, which at birth in China is currently 119 boys to 100 girls. This compares with the natural rate of 106:100. This is already causing social problems, which are likely to multiply in the future. Selective abortion after prenatal screening is a major cause of the wide gap between the actual rate and the natural rate. But, even if a female child is born, her lifespan may be sharply curtailed by infanticide or deliberate neglect. A paper published in 2008 estimated that China had 32 million more men aged under 20 than women.

8.01.02

1 1939.

2 For example: longer maternity and paternity leave; higher child benefits; improved tax allowances for larger families.

3 In 2014, France's total fertility rate was 2.0 compared with 1.9 in the UK, 1.4 in Germany and Italy, and 1.3 in Spain.

8.02.01

1 'The tragedy of the commons' is a term used to explain what has happened in many fishing grounds. Because the seas and oceans have historically been viewed as common areas, open to everyone, the capacity of fishing vessels operating in many areas has exceeded the amount of fish available. The result has been resource depletion. The global fishing fleet is two to three times larger than the oceans can sustainably support.

2 Fifty-three per cent of the world's fisheries are fully exploited; 32 per cent are overexploited, depleted or recovering from depletion; several important fish populations have declined to such an extent that their survival is threatened; every year billions of unwanted fish and other animals (dolphins, marine turtles, seabirds, sharks, etc.) die because of inefficient, illegal and destructive fishing practices.

3 The CFP has evolved over a number of stages. Current measures to conserve fish stocks include: taking a long-term approach by fixing total allowable catches on the basis of fish stocks; introducing accompanying conservation measures; setting recovery plans for stocks below the safe biological limits; managing the introduction of new vessels and the scrapping of old vessels in such a way as to reduce the overall capacity of the EU fleet; measures to neutralise the socioeconomic consequences of fleet reduction; measures to encourage the development of sustainable aquaculture.

The number of small fish caught is limited by: minimum mesh sizes; closure of certain areas to protect fish stocks; the banning of certain types of fishing; recording catches and landings in special log books.

Supporters of the CFC argue that it makes a strong contribution in the quest for sustainable fishing. However, environmentalists believe that short-term economic and political concerns override the objective of sustainability.

8.03.01

1 18 410 tonnes of domestic refuse is generated by the city every day.

2 By 2014, Beijing had 37 waste disposal facilities with a daily processing capacity of 22 000 tonnes. This included: nine waste transfer stations, four incineration plants, 16 sanitary landfill sites, six composting plants and two food waste treatment plants.

3 The Lujiashan incinerator, which is the world's largest, began operating at full capacity in Beijing in late 2014. It can process 3000 tonnes of household waste a day. This is about one-sixth of the daily domestic waste generated in the city.

8.04.01

1 China is about 25 per cent above the per-capita globally available biocapacity, whereas the USA's ecological footprint is about four times this level. In comparison, the footprint for Bangladesh is extremely low, at less than half of global available biocapacity.

2 For example, the USA's carbon footprint accounts for over two-thirds of its overall ecological footprint. The fraction of the overall ecological footprint made up by the carbon footprint is considerably less for China and lower still for Bangladesh. While the carbon footprint is the largest component for both the USA and China, in Bangladesh it is second to the footprint from cropland. The extremely high per-capita usage of energy in all sectors of the economy largely explains the USA's carbon footprint.

3 The ecological footprints for all three countries have changed between 1961 and 2010. In the USA, after a period of relative stability the country's ecological footprint declined modesty to narrow the gap with biocapacity. For China it has been a very different picture, with a rapidly rising ecological footprint over the last decade. The ecological footprint in Bangladesh has been rising for the past two decades at a significant rate, although not as fast as that for China.

4 You could arrange the ecological footprints in rank order, calculate the average, and discuss reasons for variation from the average.