

Osprey and Salmon Education Pack

A Resource to Support the
5 - 14 Environmental Studies Curriculum



THE Tweed
FOUNDATION



The Osprey and Salmon Education Pack is supported by:

The Forestry Commission Scotland



The Tweed Forum



The Tweed Foundation



Bridging the Border Education Project



The Royal Society for the Protection of Birds



The Atlantic Salmon Trust



Introduction

Osprey and Salmon Education Pack

The Connection between Ospreys and Salmon

Historically, the contrast between Salmon and Ospreys is that while the former were and still are useful to man, the latter were seen as a threat to man's interests. Therefore, until recently, while man has had a vested interest in protecting Salmon, Ospreys were regarded as competition. Indeed laws protecting and enhancing Salmon go back 500 years in Scotland.

Generally speaking, wildlife that is of use to man whether as food, sport, or both has been protected against wildlife that were seen as a threat to them, their natural predators.

The histories of these two species are thus very different. Salmon have been protected whilst Ospreys were exterminated.

The degree to which natural predators can reduce the numbers of a wildlife species that is of interest to man is a lively subject of research. There is however no doubt that man and the natural predators of species such as the Salmon are in competition with each other for the "exploitable surplus" of these species. The question is to what degree and whether this is economically significant or not.

So why, despite this long-standing protection, did Salmon catches decline so much by the mid 19th century?

The answer lies in the industrialisation of the Borders at this time. The demand for water by the textile industry for both power and industrial processes resulted in the building of caulds to provide a steady supply of water to the mills. Many of these caulds were built (illegally) without fish ladders, effectively damming the rivers. The result of this was to cut off whole areas of the Tweed catchment that the Salmon needed to breed.

The recolonisation of the Osprey



The Osprey, once hunted to extinction in Britain, has made a remarkable recovery in numbers over the past few years.

Much of this recolonisation of Ospreys has been due to the enormous effort made by environmental organisations and government agencies. Indeed the recolonisation of Ospreys has been an overwhelming success story for conservation.

Following extinction in 1916, it wasn't until the 1950s that Ospreys started to return to Scotland. They have slowly increased in numbers and in Scotland have successfully recolonised much of their former range, including, since 1998, the Scottish Borders.

Today there are over 180 breeding pairs of Ospreys in Scotland, thanks to the efforts of Forestry Commission Scotland, RSPB Scotland, the Scottish Raptor Study Groups, the Scottish Wildlife Trust, The Highland Foundation for Wildlife and many other individuals and landowners who have helped to conserve this magnificent bird.

2004 marked the 50th anniversary of the Osprey's return, and to celebrate this, 6 sites are being promoted where you can see CCTV pictures live from osprey nests.

Two of these Osprey Watch Centres are in the Scottish Borders, one at Glentress Forest and the other at Kailzie Gardens, both near Peebles.

Others are at the RSPB's Loch Garten Osprey Centre at Abernethy Forest Nature Reserve near Boat of Garten, the Forestry Commission's David Marshall Lodge in the Queen Elizabeth Forest Park near Aberfoyle, the Scottish Wildlife Trust's Loch of the Lowes Reserve near Dunkeld, and Dumfries and Galloway Council's County Buildings in Wigtown.

Full details of all these centres are given in Appendix 1.

The Recovery in Salmon numbers

As already stated, old laws protecting the Salmon go back 500 years. However, these laws which made illegal the catching of juveniles, spawning or near-spawning adults and, more recently, spent adults known as kelts, referred only to the protection of individuals of the species. There were also laws requiring that dams or caulds have fish ladders but these were often not enforced.

However, none of these old laws protected the habitat of the Salmon from damage caused by pollution, drainage or the canalisation of streams all of which led to habitat destruction.

The industrialisation of the Borders and the growth of towns such as Hawick, Galashiels, Selkirk and Peebles led to a massive increase in water pollution both from the mills and from domestic sewage. In the 19th century and early part of the 20th century, industrial waste from the mills and human waste had turned some of the rivers that feed the Tweed into little more than open sewers.

In 1913, the Gala Water below Galashiels was described as:

"The grey-blue liquid that sluggishly oozes down the river's bed among stones thickly coated with sewage fungus, is an outrage on nature most saddening to look upon. He does wisely who stands to windward of the abomination"

The development of sewage works in all the towns and villages and the control of industrial waste slowly improved the water quality of the Tweed.

With the introduction of coal and then electricity to power the mills, the dependency on water was reduced and many of the caulds became redundant. Some had fish ladders added, others had sections blown out of them with explosives to allow the passage of migratory fish.

The Tweed can now be considered as a post-industrial, recovered, river as it is no longer polluted and all the caulds have fish passes even though there are very few mills left that use the water. Most of these old caulds have been left in place as their removal could create much instability. Indeed there can be few schools in the Borders that do not have a cauld close by.

As long term netting records show, there was a major collapse in Tweed catches in the late 1850s and these remained low for almost 100 years. Drainage, cauld building, overfishing by nets and pollution all contributed to this.

Whilst the opening up of the rivers has led to a gradual recolonisation by Salmon of those areas of the catchment previously dammed, there have also been more fish in the river to allow such recolonisation.

Up to the early 1970s, Salmon was seen as luxury food commanding a high price with much of the fish available commercially coming from the traditional net and coble fishing method.

The advent of fish farming flooded the market with cheap Salmon and, at about the same time, the introduction of more efficient drift netting methods at sea meant that the traditional net and coble fishing became less and less viable. The result was that many of the coastal netsmen took the chance of selling their licenses to the sport fishing industry, retiring their netting stations.

Sport fishing has now taken over as the prime use for Salmon. A net caught salmon carcass may be only worth a few pounds per pound. A salmon caught by an angler is worth hundreds or even thousands to the local economy. Anglers pay rents for their fishing; stay in hotels and guesthouses; eat at restaurants; buy fuel and fishing tackle etc. The 1996 economic survey of the Tweed Salmon Fishery showed that it brought £13.5 million into the economy and directly supported 500 to 550 local jobs.

Much of the success in recolonisation of the Osprey and the recovery in Salmon numbers has been by educating those concerned. This pack aims to continue that education process by looking at how aspects of the 5-14 Environmental Studies Curriculum can be supported by topic work on Ospreys and Salmon.

As further support for this education process, the Salmon Viewing Centre at Philiphaugh Estate near Selkirk has recently been opened and a Community Wildlife Officer for both this centre and the Osprey Watch Centres appointed. Contact details for the Community Wildlife Officer are also included in Appendix 1.

We hope you find this pack, and the Osprey Watch and Salmon Viewing Centres, a valuable resource.



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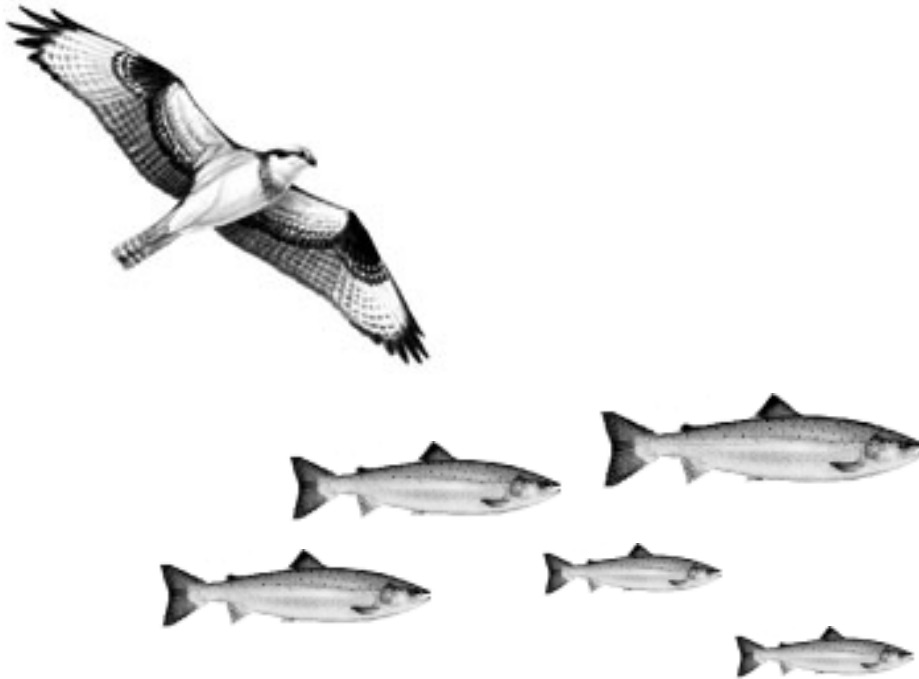
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Osprey and Salmon Education Pack

Resources to support the
5 - 14 Environmental Studies Curriculum

Topic Overview



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Attainment target	Level	Page
Give examples of living things that are rare or extinct.	C	2
Explain how living things and the environment can be protected and give examples.	C	2
Describe examples of human impact on the environment that brought about beneficial changes and examples that have detrimental effects.	D	3
Give examples of how animals are suited to their environment.	D	3
Explain how responses to changes in the environment might increase the chances of survival.	D	4
Describe some methods used and reasons for conserving major resources e.g. fish.....	D	4

Attainment Targets	Learning Outcomes	Activities to develop the Learning Outcomes	Assessment Activities
<ul style="list-style-type: none"> • describe examples of human impact on the environment that brought about beneficial changes and examples that have detrimental effects. (level D) • give examples of how (<i>plants and</i>) animals are suited to their environment. (level D) 	<p>7. Industrial development and associated structures can adversely affect the natural life cycle of a species.</p> <p>8. Man-made pollution can cause devastating effects on the environment.</p> <p>9. The provision of wildlife/nature reserves can maintain the biodiversity of a habitat.</p> <p>10. The biodiversity of an area is dependent on the quantity and range of resources (food, shelter etc.) found within the area.</p> <p>11. Ospreys migrate annually in order to ensure a supply of food.</p> <p>12. The life cycle of Salmon includes a migratory period in order to ensure an adequate supply of food at all stages in that life cycle.</p>	<p>Activity 6: A look at the effect that the man-made barriers - "caulds" - built at the time of industrialisation in the Borders have had on the natural migration patterns of the Salmon and how pollution, caused as a result of industrialisation, greatly affected salmon stocks in the rivers.</p> <p>Activity 7: Discuss the problems of setting aside areas for nature reserves. (A visit to one of the Osprey Watch Centres at Glentress Forest or Kailzie Gardens or the Philiphaugh Salmon Viewing Centre may well fit in here.)</p> <p>Activity 8: A look at the habitats that Ospreys and Salmon inhabit and their food requirements.</p> <p>Activity 9: A look at the reasons for the annual migration of the Osprey.</p> <p>Activity 10: A look at the life cycle of the Salmon from a river to the sea and back again in order to obtain both adequate food supplies and ideal conditions for reproduction.</p>	<p>Children can find out about a local or national nature reserve and report back to the class/group.</p>

Attainment Targets	Learning Outcomes	Activities to develop the Learning Outcomes	Assessment Activities
<ul style="list-style-type: none"> • explain how responses to changes in the environment might increase the chances of survival. (level D) • describe some methods used and reasons for conserving major resources e.g. fish.... (level D) 	<p>13. The more an animal can tolerate changes in its environment, the more likely it is to survive.</p> <p>14. The more food sources an animal can feed from, the more likely it is to survive.</p> <p>15. Control of fishing methods can greatly increase fish stocks.</p>	<p>Activity 11: A look at the specific habitat requirements of the Osprey and Salmon. Animals with a very specific diet are vulnerable to habitat change. Others with a more varied diet or those that can adapt to habitat change are more likely to survive.</p> <p>Activity 12: A look at how the changes in fishing methods in recent years have increased the numbers of Salmon in Scottish rivers and in the River Tweed in particular.</p>	<p>Children can plan some simple experiments to show that animals will be attracted to the most beneficial living environment.</p>



Osprey and Salmon Education Pack

Resources to support the
5 - 14 Environmental Studies Curriculum

Activities and Worksheets



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Activity 1 - Rare, Endangered and Extinct Animals

Rare, Endangered, Extinct - what do we mean?

Rare - this means that there are very few of a particular animal in existence. This may be entirely natural as in the case of certain animals which, through time, have become isolated on say a particular island. However in the area that they exist, they may be common. In this instance we say they are 'locally common'.

However, it may be that due to hunting, or a change in their environment caused by man, an animal which was once common is now much less so. We might say these animals are 'unnaturally rare' or scarce although this does not necessarily mean that this type of animal will die out.

Endangered - animals in this group are both rare and in danger of becoming extinct. In most cases this has been caused by man either hunting animals to the point where they may die out or by changing their environment, for example by pollution, so that the animals are no longer able to exist.

Extinct - this is the most simple. It means that an animal that once lived no longer exists. The reason for this extinction may be natural as in the case of the dinosaurs or it may be caused by man.

Here are some examples of all three groups.

Once Rare - Salmon

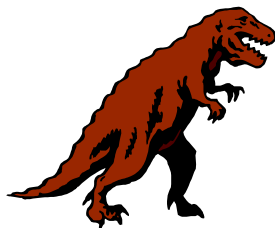


Man-made barriers, river pollution and overfishing greatly reduced the numbers of Salmon in many rivers in Britain. In some rivers they became rare. The removal of these barriers and control of pollution has meant that Salmon are now no longer rare and in some rivers like the Tweed are common.



Endangered - Osprey

Once persecuted to extinction in Britain, Ospreys have re-colonised some of the areas in which they formerly lived, including the Scottish Borders.



Extinct - Dinosaurs

Around 65 million years ago, dinosaurs ruled the world. Being reptiles, and so cold blooded, they had to live in warm places. It is thought that they became extinct due to a meteor or comet strike which cooled the world's climate by so much by that they could no longer survive. This would be called a natural extinction.

Your task:

See if you can find out some more examples of all three groups.

You can use your school library, or perhaps the internet to find out more.













Activity 1 - Rare, Endangered and Extinct Animals

Worksheet - rare, endangered or extinct - which is which?

Here are some other animals, many of which either still live in Britain or once lived here that are either rare, endangered or extinct .

See if you can find out which is which and tick the correct box.

		Rare	Endangered	Extinct
Pine Marten		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Woolly Mammoth		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pterodactyl		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scottish Wildcat		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Swallowtail Butterfly		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Otter		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
White Tailed Eagle		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Red Squirrel		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





Activity 2 - The Decline and Recolonisation of the Osprey

Why did the Osprey become extinct and how have they recolonised some of the areas in which they formerly lived ?

There are many reasons why Ospreys became extinct in Britain and here are some of them:

Time line	Reasons for the decline in Osprey numbers
Middle ages	Ospreys were killed as they were seen as a threat to fish stocks in fish ponds that were used as a source of food.
18th and 19th centuries	Improvement of land for agriculture led to the destruction of their habitat and in particular destruction of nest sites. The invention of the gun and in particular the shotgun in the 19th century increased the numbers killed by gamekeepers.
Victorian period 19th century	The fashion for specimen collecting, and in particular egg collecting, greatly reduced breeding success. This was made worse by an increase in the shooting of Ospreys that were considered as vermin as they ate trout and salmon.
1916	Last known breeding pair in Scotland. From this date, Ospreys considered extinct as breeding birds in Britain.
1917 to 1950's	During this period, Ospreys are still occasionally seen in Britain while on migration but no breeding success.
1950's and 1960's	Worldwide threat to the osprey and many other birds of prey due to the use of DDT pesticide in agriculture. This caused a build up of DDT in the food chain which led to many birds, including Ospreys, laying very thin shelled eggs which broke very easily and so reduced breeding success.
1954	First pair returned naturally to Loch Garten.
1955/6	Ospreys tried to build nests in Scotland but breeding failed. Birds still being shot and eggs stolen.
1958	Nest established but once again the eggs were stolen.
1959	First successful breeding at Loch Garten.
Today	Many wild birds are still killed for sport in countries such as Italy as they pass on their annual migration and it is possible that this may include the occasional Osprey.





Time Line

Reasons why Ospreys returned to Britain

Early 20th century	A healthy population of breeding Ospreys still survived in Scandinavia.
1930's to the 1950's	Some of these birds were seen in Scotland on migration north in the spring but breeding attempts failed
1959	First successful breeding at Loch Garten, probably from the population in Scandinavia.
1960's	More breeding pairs established nests in Scotland.
1970's	DDT pesticide phased out.
1970's to the present	Breeding populations in Europe slowly increased back to normal levels. Continued breeding success in Scotland from 2 pairs in 1967 to 150 pairs in 2000. Most of these are in the more remote areas of Scotland.
1981	Osprey given the highest level of legal protection against shooting and egg collecting.
1998	First successful breeding in the Scottish Borders
1999	Ospreys released in central England at Rutland Water.
2001	First breeding success of the Rutland Ospreys.
2003 to 2005	Continued success of a breeding pair at Rutland water.
2004	Birds hatched at Rutland Water seen breeding in Wales.
2005	An estimated 180+ pairs now breeding in Scotland including an estimated 5 pairs in the Scottish Borders.





Activity 2 - The Recolonisation of the Osprey in the Scottish Borders

Time Line	Nest site	Nesting history in the Scottish Borders
1998	Site 1	First successful breeding in the Scottish Borders, 1 young.
1999	Site 1	2 more young fledged at the same site as used in 1998.
2000	Site 1 Site 2	3 more young fledged at the same site as used in 1998. Another pair failed to breed at a new site.
2001	Site 1 Site 2	1 young fledged at the 1998 site. Again a pair failed at the new site.
2002	Site 1 Site 2 Site 3(TV) Site 4	A pair laid eggs but the chicks died while still small. The site was not occupied. 3 chicks were raised at a at new, nearby site. (This is the site seen in the live TV camera footage at Glentress and Kailzie Gardens Osprey Centres.) Nest built but this was destroyed by wind.
2003	Site 1 Sites 2 & 4 Site 3 (TV) Site 5	An immature pair arrived late but did not breed. No Ospreys present. At the TV camera site, 3 young were again reared. Another pair, possibly the birds that tried to breed in 2002 at Site 1, reared 3 young at a new back-up nest site. Birds were present but not breeding at three other sites
2004	Sites 1, 2 & 4 Site 3 (TV) Site 5 Site 6 Site 7	No birds present. 3 eggs laid but only 2 young were reared. 3 young reared. 2 young reared for first time at one of the sites where birds were first present in 2003. A pair were present at a new site but did not breed.
2005	Sites 1, 2 & 4 Site 3 (TV) Site 5 Site 6 Site 7 Site 8	No birds again at these sites. 3 reared at the TV camera site. 4 reared. 2 reared. A pair at the site first occupied in 2004 were present but failed to breed. A pair at a new site reared 1 young.
2006	Sites 1, 2 & 4 Site 3 (TV) Site 5 Site 6 Site 7 Site 8 Site 9	No birds again at these sites. 2 reared at the TV camera site. 3 reared (new back-up TV site) 3 reared Failed to breed 1 reared New nest site - 1 young reared





Activity 2 - The Recolonisation of the Osprey

Worksheet - Ospreys in the Scottish Borders

On page 10 there is a lot of information about how many Ospreys have been reared in the Scottish Borders between 1998 and 2006.

See if you can use that information to answer these questions.

1. Between 1998 and 2006, how many Ospreys have been reared successfully at each nest site?

Nest site 1

Nest site 2

Nest site 3 (TV camera)

Nest site 4

Nest site 5

Nest site 6

Nest site 7

Nest site 8

Nest site 9

2. How many Ospreys have been reared altogether?

3. Tick the boxes to show in which years was each nest site was successfully used for breeding?

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Nest site 1									
Nest site 2									
Nest site 3									
Nest site 4									
Nest site 5									
Nest site 6									
Nest site 7									
Nest site 8									
Nest site 9									





4. What happened at nest site 2 in 2000 and 2001?

.....
.....

5. What happened at nest site 1 in 2002?

.....
.....

6. What happened at nest site 4 in 2002?

.....
.....

7. In 2003, why were the the birds at nest site 1 not able to breed?

.....
.....

8. The birds that nested at site 5 in 2003 had tried to breed the year before.

Which nest site did they use in 2002?

9. In 2004, how many eggs were laid at nest site 3?

How many chicks survived?

10. How many completely new nest sites were established in 2005?





Activity 3 - The recovery of Salmon numbers in the Tweed

Why did the number of Salmon in the Tweed decline in the past and how have they increased in recent years ?

The decline in the number of Salmon in the Tweed started in the mid 1850s. Here are some of the reasons.

Time line	Reasons for the decline in Salmon numbers
In the past	Salmon plentiful in the Tweed.
Late 18th century	Start of the textile industry in the Scottish Borders area, mainly in Galashiels and Hawick.
Early 19th century	Large scale industrialisation of much of the Scottish Borders area. Caulds built for the mills prevent Salmon from migrating upstream to their spawning grounds.
1810's	Increase in land drainage.
1825	Population of Galashiels 1,600.
1830's & 1840's	Scottish Borders area by now the main producer of textiles in Britain. Increasing pollution from the mills of dyes and chemicals Increasing population of the Border towns leads to an increase in raw sewage in the rivers feeding the Tweed.
1850's	Major collapse in Salmon netting catches in the Tweed.
Late 19th century	Hundreds of Salmon and Trout killed in pollution incidents.
1891	Population of Galashiels 18,000.
Early 20th century	Tweed at its most polluted from both the mills and also from agricultural activities such as sheep dipping.





Time line	Reasons for the recovery in Salmon numbers
1900 to 1950's	Salmon catches still very low.
Early 20th century	Sewage works established in Border towns to improve public health and reduce pollution in the Tweed.
1930's	Start of the decline of the textile industry.
1930's to 1950's	Some caulds opened up, often by floods and either not repaired or repaired with a fish ladder added. Salmon start to recolonise rivers above the damaged caulds.
1951	Tweed River Purification Board established.
1950's to 1960's	Pollution incidents reduced. Salmon stocks start to increase.
1970's to 1980's	Farmed Salmon introduced - price of Salmon falls. Fishing at sea for Salmon made more efficient. Net and Coble fishing becomes less profitable. Some net and coble licences sold to angling organisations. Introduction of scientific study of Salmon numbers in the Tweed by electro-fishing.
1983	Tweed Foundation established to promote the sustainable development of fish stocks in the Tweed River System. Scientific study of Salmon stocks continued showing further increases in Salmon stocks.
1990's	All caulds now opened up.
1995	Scottish Environment Protection Agency replaces the Teed River Purification board with more powers. Pollution no longer a major problem in the Tweed system.
1990's to present	Net fishing for Salmon at sea reduced. Salmon numbers continue to increase and Salmon stocks now at a healthy level. Salmon angling now a major contributor to the economy of the Scottish Borders.





Activity 3 - The recovery of Salmon in the Tweed

Worksheet - The decline and recovery in Salmon numbers

From the information on pages 13 and 14, see if you can answer these questions.

1. Name two of the main reasons that the numbers of Salmon caught in the Tweed had collapsed by the 1850's.

.....
.....

2. Apart from dyes and chemicals from the mills, what was the other main cause of pollution from the towns?

.....
.....

3. Which agricultural process also contributed to increasing pollution in the Tweed?

.....
.....

4. Between 1825 and 1891 the population of Galashiels increased by:

Less than 5,000 people

5,000 to 10,000 people

More than 10,000 people

5. What was built in the early 20th century to reduce pollution in the Tweed and also increase public health?

.....
.....





6. In the 1930's to 1950's Salmon managed to reach areas of the Tweed system that they had not been able to reach for over 100 years.

Why was this?

.....
.....
.....
.....

7. What was the main reason for the drop in Salmon prices in the 1970's?

.....
.....

8. What type of fishing suffered most from the fall in the price of Salmon in the 1970's?

.....

9. What type of "fishing" is used for the scientific study of Salmon numbers?

.....

10. Angling for Salmon is now a major contributor to the economy of the Scottish Borders. Anglers pay to be allowed to catch the Salmon.

Can you think of three things other than angling that anglers spend money on when they visit the Borders?

.....
.....
.....





Activity 4 - Environmentally Friendly Products

What products do we use that are bad for the environment?

Just think of all the things that people use in their daily lives.



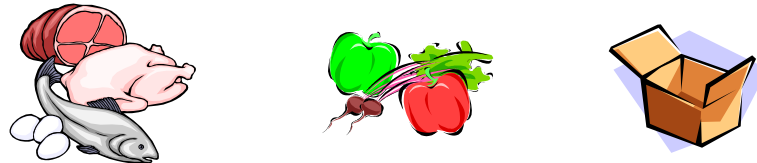
What happens when we have finished with them?



Lots of these things are made of **materials**, or contain **chemicals**, that are dangerous to the environment. Let's think about some of these.

Materials

Some materials like these will break down over a period of time. We call materials like this **Biodegradable**



Some materials can be reused and we call these **Recyclable**



Paper - most paper products are biodegradable and will rot down very quickly.



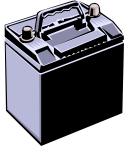
Glass - glass is not biodegradable and if thrown away will last for ever. Also broken glass can be very dangerous. However it can easily be melted down and made into new glass, for example into bottles. It all depends on how we get rid of used glass.





Metals - some metals such as iron will eventually rust away but many others will not.

However most metals can be reused and so are recyclable. Many are quite valuable like the lead in car batteries.



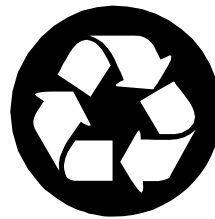
It all depends on how we get rid of waste metal objects.



Plastics - some plastics are biodegradable but many are not. This means that if thrown away they may last for hundreds or thousands of years.



Some plastic is recyclable and will be marked with a symbol like this.



Chemicals



Many of the chemicals used in factories and many that we use every day, such as oils and cleaning materials, are poisonous to both humans and wildlife. We must be very careful how we get rid of chemical waste.



Sometimes, like in some aerosols, it is the substance that the chemical is mixed with that is dangerous.



More recently a lot of cleaning materials have been produced which are either much less poisonous or will quickly and easily break down once they get in the environment. Once again we call these products biodegradable.

If you see symbols like these on any product, they will be dangerous to wildlife and must be disposed of carefully and definitely not poured down the drain.



Have a look around you home and find out about some of these products.

The worksheet on page 19 will help you.





Activity 4 - Environmentally Friendly Products

Worksheet - looking at cleaning materials?

IMPORTANT - Get an adult to help you with this worksheet

Many of the cleaning products or other fluids that we find around the home are labelled as being 'Environmentally Friendly'. Most of them you will find in the kitchen but some may be in a shed or garage.

Here is a list of some of these products.

Have a look at home and see if any of the labels say something like:

- Environmentally Friendly or Biodegradable
- Dangerous (sometimes called Hazardous) or have a 'Caution' notice
- Dispose of safely

Tick the boxes that apply to each product - there may be more than one for each product.

	Environmentally friendly	Dangerous (or hazardous)	Dispose of safely
Washing up liquid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Washing machine powder or liquid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dishwasher powder or liquid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oven cleaner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bleach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Floor cleaner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Paint	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Car oil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

You may have found that a product is both environmentally friendly meaning that it is biodegradable but also is dangerous or hazardous to humans.

If any of the products say 'Dispose of Safely' then **NEVER** tip them down the drain as they can poison water life.





Activity 5 - Protected Species

How does protecting Ospreys help their survival?

Ospreys can live for up to 30 years although the average age of the adults is about 8 years old.

Ospreys can start to breed once they are 3 years old, but many die before they reach this age.

What happens to all the young Ospreys? Here are some of the things that might cause the Ospreys to die early:

Natural deaths	Accidental deaths due to man	Deliberate deaths due to man
<ul style="list-style-type: none"> • Bad weather while migrating • Starvation • Nest destruction 	<ul style="list-style-type: none"> • Pesticides • Deserting the nest • Tangled in fishing lines 	<ul style="list-style-type: none"> • Shooting • Egg collecting

Natural deaths - these are ones that we can do nothing about.

- **Weather** - Ospreys migrate from their summer breeding sites in Northern Europe to their winter feeding areas in Africa. During this long migration, some birds can be blown off course and die either directly due to the weather or because they end up in areas where they cannot get enough food.
- **Starvation** - all Ospreys feed on fish and they will only nest successfully near a reliable source of food. However, some young adults may attempt to nest in an area that does not have a suitable supply of fish and the young will die of starvation.
- **Nest destruction** - a pair of Ospreys will usually build their nest at the very top of a tall tree. This gives a broad flat platform for the nest to be built on. Sometimes they will use an electricity pylon, a radio mast or an artificial nesting platform.

If the nest gets very wet it can get so heavy it will break the branches and fall to the ground breaking the unhatched eggs or killing the chicks. Also because they are so high in a tree the nests can be damaged in severe gales and so again cause the eggs to be broken or the chicks to be killed.

This is more likely to occur when young inexperienced birds try to build a nest in a tree that has not been used before. Older nest sites that are used year after year are usually in stronger trees or trees that are in a more sheltered location.





Accidental deaths due to man - these are ones that we can reduce.

- **Pesticides** - some of the pesticides used by man to prevent damage to crops are poisonous to Ospreys. They affect the birds if the pesticide gets washed into rivers and gets taken in by the fish. Then when the Ospreys eat the fish they get poisoned. We can prevent this by reducing the amount of pesticide used and by more careful application of pesticides, particularly near streams and rivers.
- **Deserting the nest** - Ospreys will put up with regular activities such as passing cars or boats. However, if they are disturbed either deliberately or accidentally in a way they are not used to, they may desert the nest. If this happens, the eggs will not hatch or the chicks will starve to death or die from cold.
- **Tangled in fishing lines** - this is not too much of a problem in Britain as the Ospreys nest in areas where most of the fishing is for sport using a rod and line. However, on their migration, the Ospreys will pass areas where long lines of baited hooks are left for periods of time. They may see what appears to be an easy food source close to the surface but when they try to take the fish, they get tangled in the lines. This can be reduced by more careful use of fishing lines in areas where the Ospreys feed.

Deliberate deaths due to man - these are the deaths we can prevent

Legal protection - Ospreys have the highest level of legal protection of any birds in Britain.

It is against the law to take, injure or kill an osprey or to take, damage or destroy its nest, eggs or young.

It is also against the law to **intentionally** disturb the birds close to their nest during the breeding season.

Breaking this law can result in a fine up to £5,000 and/or a prison sentence of up to 6 months each time the law is broken.

- **Egg collecting** - collecting eggs from the nests of all wild birds is against the law. However, there have been many instances of egg collectors stealing Osprey eggs just because they are so rare. A round-the-clock watch is kept on many of the better known Osprey nest sites in order to prevent the eggs being stolen. Many of the more remote nest sites are kept secret.
- **Shooting** - Ospreys now have the highest level of legal protection of any birds in Britain and it is unlikely that any are shot.

Unfortunately this is not the case in southern Europe. In countries such as Italy, many birds are shot for sport on their annual migration. It is possible that some of these are Ospreys, although they will be ones that nest in other parts of Europe. The birds that nest in Britain migrate across Spain where shooting is much less common.





Activity 5 - Protected Species

Worksheet - how does protecting Ospreys help their survival?







Ospreys are protected by law and breaking this law can result in a big fine or imprisonment. Having this law helps to prevent Ospreys being killed.

The law says that it is illegal to take, injure or kill an Osprey or to take, damage or destroy its nest, eggs or young.

It is also against the law to **intentionally** disturb the birds close to their nest during the breeding season.

Below you can see some of the things that humans do that might disturb, injure or kill Ospreys, either deliberately or accidentally.

Think about the activity and then tick the box you think is correct.

	Yes the law will protect the Ospreys	No the law will not protect the Ospreys
 Using land for building	<input type="checkbox"/>	<input type="checkbox"/>
 Shooting wild birds	<input type="checkbox"/>	<input type="checkbox"/>
 Crop spraying	<input type="checkbox"/>	<input type="checkbox"/>
 Planting trees for forestry	<input type="checkbox"/>	<input type="checkbox"/>
 Stealing eggs or chicks from the nest	<input type="checkbox"/>	<input type="checkbox"/>
 Pollution of rivers and lochs	<input type="checkbox"/>	<input type="checkbox"/>





Activity 6 - How human activity affects wildlife.

How has human activity affected Salmon?

Up to about 200 years ago there were thousands of Salmon in the Tweed river system. Then around the year 1790, the textile industry in Britain looked for a source of clean, fast flowing water to power the waterwheels and for the washing and dyeing of wool. They found this in the River Tweed.

So, from about 1800 to 1850, many of the rivers in the Tweed catchment had a dam or "cauld" built across them to divert water down a channel called a "lade" to the mills.



Here you can see a cauld with a fish ladder in the middle. This allows Salmon to pass upstream as they migrate from the sea to their breeding grounds in the small streams and burns upstream of the cauld.



The law at the time stated that caulds should be built with fish ladders, but this was often ignored. Many were built without a fish ladder as the law was not enforced. As the fish could not pass, they were not able to reach the streams they needed to breed in and so the numbers of Salmon in the Tweed started to drop.

As if this was not bad enough, the waste chemicals used in the textile mills for washing the fleeces and dyeing the wool were put straight into the rivers polluting the water. On the next page you will see some eyewitness accounts of the state of the rivers at the start of the 20th century.





Here are some reports from around the end of the 19th century and very early 20th century when pollution was at its worst:

Hawick and Jedburgh

"I saw the Teviot oozing, not flowing, between its wooded banks, a mere sluggish injection among the poisonous pools of scum-covered ink. And in front of Jedburgh Abbey, where the foaming river (the Jed Water) used to dash round the sweet ruinsthe whole stream of it carried to work in the mills, the dry stones and crags of it festering unseemly in the evening sun.."

Galashiels

"The grey-blue liquid that sluggishly oozes down the river's bed among stones thickly coated with sewage fungus, is an outrage on nature most saddening to look upon. He does wisely who stands to windward of the abomination"

The Tweed below Galashiels

"The river Tweed, below the point at which the Gala discharges into it is greatly polluted. The water is grey black and gives off a foul odour; the stones of the river are covered with sewage fungus, which is coloured by dye to a blueish black colour.....the water is not apparently capable of sustaining animal life, of which no sign can be seen. In the course of four miles, when it reaches Melrose, the water has improved greatly in appearance under ordinary circumstances, but the stones of the river bed are coated with slime"

Kelso

"We heard complaints of the foul condition of the water of the Teviot, which receives the drainage of Hawick and Jedburgh and we noted that from this river was derived a large amount of oily scum, which travelled along the south bank of the Tweed for a considerable distance before being broken up by agitation of the water. It was also stated that the deposit left by the Teviot was offensive at times, and that the water coming from it caused an offensive smell perceptible at the upper part of the town in warm weather"

Berwick

"A number of complaints as to the condition of the Tweed as affecting the Salmon fishery were heard. It was stated that a moderate flood was the most serious, since polluting matter was washed into the river from the higher reaches and not sufficiently diluted to be innocuous, nor swept out to sea sufficiently fast. Under such conditions it was stated that salmon were prevented from coming up by the foul water, whereas a heavy flood did not hinder them owing to the filth being rapidly swept out to sea and the fish followed up on the flood on the clean fresh water left after the cleansing of the stream."

As you can see, the pollution was not only from the mills, but also from raw human sewage that was put straight into the rivers without any form of treatment. It is no wonder that the number of Salmon in the Tweed was so low at this time.





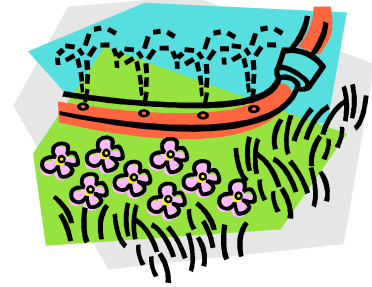
We have seen that in the past the textile industry greatly affected the number of Salmon in the Tweed. Fortunately, this is no longer the case and the Tweed is a clean river with lots of Salmon.

Here are some activities that still happen today that might affect Salmon:

Farming



Pollution of rivers by fertilisers or by chemicals used in crop spraying.



Extraction of water from the river for the irrigation of crops.

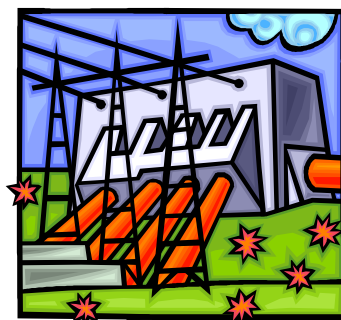
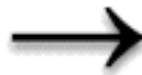
Industry



Chemical spills from factories



Dams built to provide a reservoir for water supplies



Dams built in a river to provide a reservoir for hydro-electric power

Now see if you can answer the questions on the next page about how humans affect Salmon now or in the past:





Activity 6 - How humans affect animals

Worksheet - How has human activity affected Salmon?

1. Choose one of the quotations from page 24 and in your own words write a paragraph about what it must have been like to be standing next to the river at that time.

.....

.....

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Now tick which you think is the correct answer for these questions:

2. A fish ladder is built into a cauld to:
- a. Stop fish passing the cauld
 - b. Allow fish to pass the cauld
 - c. Catch fish in the cauld
3. A lade is a water channel designed to:
- a. Provide a mill with water
 - b. Allow fish to by-pass a cauld
 - c. Provide water for farm irrigation
4. Which of these farming activities will be the **least harmful** to Salmon:
- a. Extraction of water from a river for irrigation
 - b. Draining used sheep dip into a river
 - c. Organic farming without using chemical sprays
5. Damming a river for hydro-electric power without a fish pass will:
- a. Decrease the area available for Salmon to breed
 - b. Increase the area available for Salmon to breed
 - c. Make no difference





Activity 7 - Nature Reserves for Wildlife

Can we help by setting up nature reserves?

We live in a very crowded island and there is great demand for land for activities such as farming, forestry, industry and housing. Towns and cities are expanding and every year more land is being built on.

Wildlife cannot survive without its own place to live. We call this place its **habitat**. Some animals can adapt to live in new places or by eating different food but many animals like the Osprey and Salmon need very special habitats and can only live on certain foods.

What can we do?

In many places nature reserves have been set up. Sometimes these are big reserves set up by important organisations such as the Royal Society for the Protection of Birds (RSPB) or the Scottish Wildlife Trust (SWT).

In other places they may be much smaller. Your school may have a small piece of land set aside to attract wildlife or you may have a 'wild' area in your garden at home.

Whatever the size, the job is the same - to provide wildlife with a safe and suitable place to live.

All animals need three things to survive and these are:

- **Food and water**
- **Shelter**
- **A suitable habitat in which to live and breed**

Different animals need different types of nature reserves, for example:

- wetlands - for wading birds and amphibians.
- uplands - for moorland birds, small mammals and reptiles.
- woodlands - for woodland birds, squirrels, deer, badgers, foxes and many small mammals and invertebrates.
- ponds and rivers - for water birds such as ducks and swans and for fish and invertebrates.





Activity 7 - Nature Reserves for Wildlife

Worksheet - about your local nature reserve.

You may have a nature reserve near you or you may know of one.

See if you can find out about a nature reserve and the animals that live in it.

Here are some questions to help you.

- What is special about the nature reserve?
- What types of habitat are there in the reserve?
(woodland, wetland, pond, stream, moorland, seashore, cliffs etc)
- What type of animals is it trying to help?
- Has anything been done to the land to help attract wildlife?
(tree planting, creating wetlands or a pond, fencing out sheep etc)
- Who looks after the reserve?
- Are people encouraged to visit the reserve?





Activity 7 - Nature Reserves for Wildlife

The Tweed Valley Osprey Watch Centres

There are two Osprey Watch Centres in the Tweed Valley, both near Peebles, where you can observe and learn about Ospreys.

One is at Glentress Forest



The other is at Kailzie Gardens



In the centres you will learn all about Ospreys, how they live, feed and breed and about their annual migration to and from West Africa and the Scottish Borders.

You will also learn about how the Forestry Commission has helped by constructing artificial nest platforms to encourage Ospreys to breed here.

From the end of May to the end of July you will also see live camera footage of the eggs hatching, the chicks being fed, growing up and learning to fly.

Here are some of the pictures of Ospreys on the nest.



You will also learn about some of the other wildlife of the Tweed Valley that shares its habitat with the Ospreys.

Animals such as:

Badger



Swallows



Red squirrel





Activity 7 - Nature Reserves for Wildlife

The Salmon Viewing Centre

The Salmon Viewing Centre is next to the sawmill at Philiphaugh Estate near Selkirk.

At the Centre you can learn all about the life cycle of the Salmon.

This follows its amazing journey from the river where it was laid as an egg, the egg hatching and the stages in its growth before leaving the river for the sea where it grows into an adult.

It then follows the journey back to the river where it was hatched so it can breed.

You will also learn about the food that the Salmon eats at the different stages in its life cycle.

At the Centre you will be able to watch live footage from underwater cameras and if you are lucky you may see some Salmon.



Also in the Centre, you will learn about some of the other animals that share the same habitat as the Salmon. Some of these are fish, some are birds and others are the tiny minibeasts or invertebrates that live in the river.



Grey heron



Trout



Damselfly





A short walk from the Viewing Centre will take you to the huge cauld across the Ettrick Water known as Murray's Cauld.

This cauld, built to divert water from the river into a lade to supply water to the old Philiphaugh Mill in Selkirk, was later also used to drive the waterwheel at the sawmill next to the Centre.



In the middle of the cauld you can see a salmon ladder. This was built into the cauld to allow Salmon to swim upstream. If it was not there, the Salmon could not get to the small streams and burns upstream of the cauld where they lay their eggs.



A fish counter has now been placed in the fish ladder and this allows scientists to count how many fish pass through the cauld.

Sometimes when the river is in flood, you might be able to see Salmon trying to jump up the cauld.





Activity 8 - Biodiversity

What lives where and how many different types are there?

Biodiversity is all about how many different types of animals and plants live on Earth. There is still a lot about the Earth that we don't know. New plants and animals are being discovered all the time.

Hopefully you will get a chance to visit one of the Osprey Watch Centres. There is one at Glentress Forest and another at Kailzie Gardens, both near Peebles. You might also visit the Salmon Viewing Centre at Philiphaugh near Selkirk.

Your task:

Following a visit to one of these centres, or from your own research, see if you can answer these questions.

If you were looking at Ospreys:

1. What type of place (habitat) do Ospreys need to build their nests?
2. What type of food do they eat and how do they get it?
3. What other animals compete with Ospreys for this food?
4. What predators do Ospreys have?

If you were looking at Salmon:

1. What are the different habitats that Salmon need in the different stages in their life cycle?
2. What type of food do Salmon eat at the different stages in their life cycle?
3. What other animals compete with Salmon for this food?
4. What predators do Salmon have?

You may also find other questions to ask about your research.





Activity 9 - Bird Migration

We have already seen from earlier activities that in order to survive, all animals must have three essentials:

1. Food and water
2. Shelter
3. A suitable habitat in which to live and breed

If an animal can get all these things from its habitat all year round, then it can survive in that habitat throughout the year.

However, if for example the animal cannot get suitable food at certain times of year then the animal has two choices - to hibernate or to migrate.

Birds cannot hibernate so if a bird like the Osprey cannot get enough food in the winter, its only option is to migrate.

In Britain we can divide most of our birds into three groups:

Residents - these are birds that breed in Britain and stay all year round.

Summer visitors - these are birds that come to Britain in the summer to breed but migrate south in the winter.

Winter visitors - these are birds that come to Britain from much colder parts of Europe in the winter to feed but migrate north to their breeding grounds in the summer.

Osprey migration

Northern Europe in summer is the place that Ospreys like to build their nests and bring up their young. They like to nest at the very top of a tree, often choosing old ones with flat tops or sometimes using trees that have had their top broken off.

As they only feed on fish, they also need to be near clean fresh water lochs and rivers. Habitats like these are found in Scotland and Scandinavia.

The cold winters in northern Europe mean that an adequate supply of fish may not be available as lochs and even rivers freeze over.

In order to ensure a supply of food, in the autumn the Ospreys migrate south. Those that breed in Scotland follow the west coasts of France and Spain, cross over into Africa and spend our winter in the coastal regions of West Africa where it is much warmer.

During the migration the birds will stop at any suitable lake or reservoir for several days to feed before moving on. They are therefore often seen at this time in England and Wales.





Activity 9 - Bird Migration

Worksheet - bird migration

On the next page you will see some pictures of birds that live in Britain.

Find out whether they are residents, summer visitors or winter visitors and then put them in the correct group below.

Residents

Summer visitors

Winter visitors

Residents	Summer visitors	Winter visitors

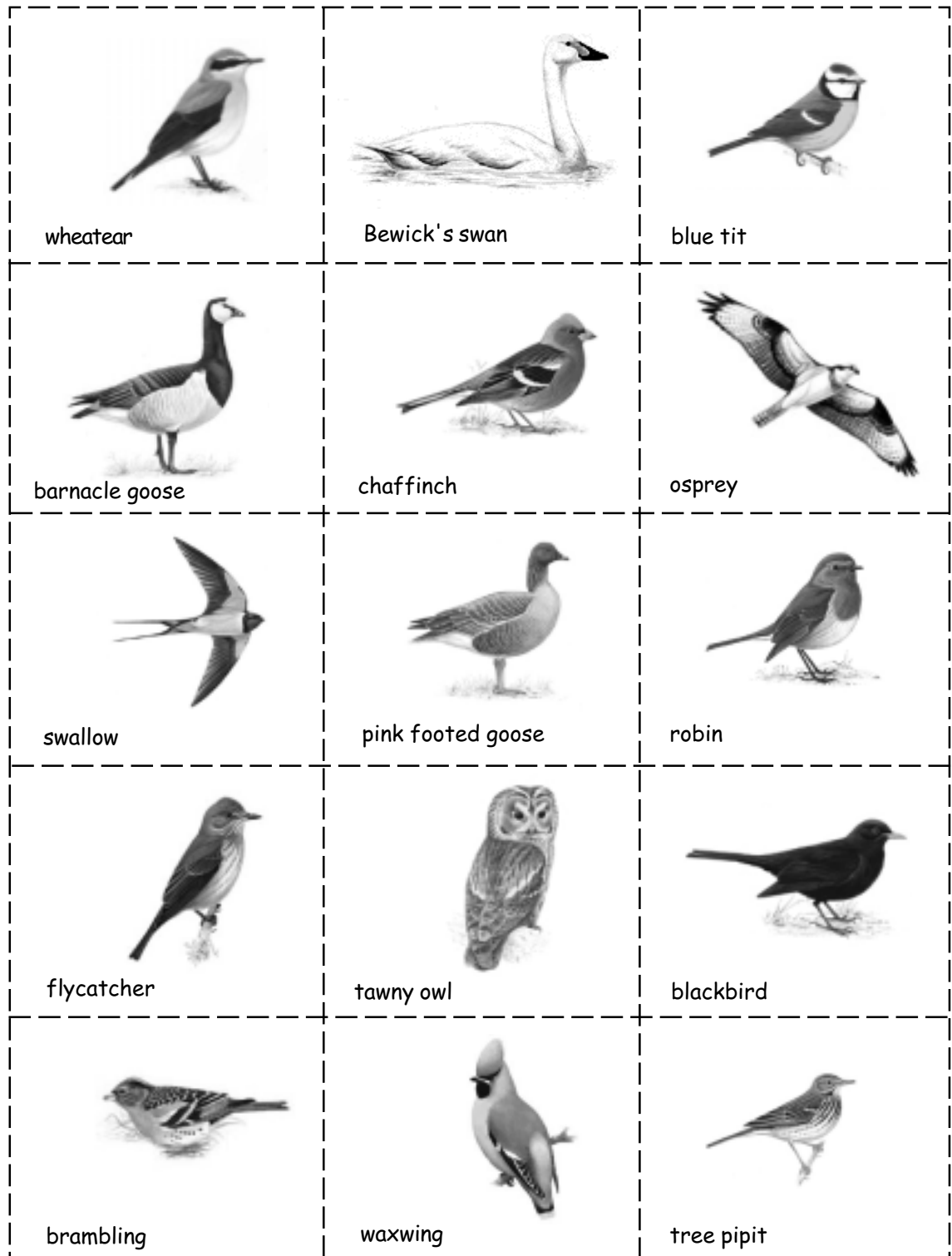




Activity 9 - Bird Migration

Picture sheet for bird migration worksheet

Cut out these pictures and put them in the correct group on the worksheet.





Activity 9 - Bird Migration

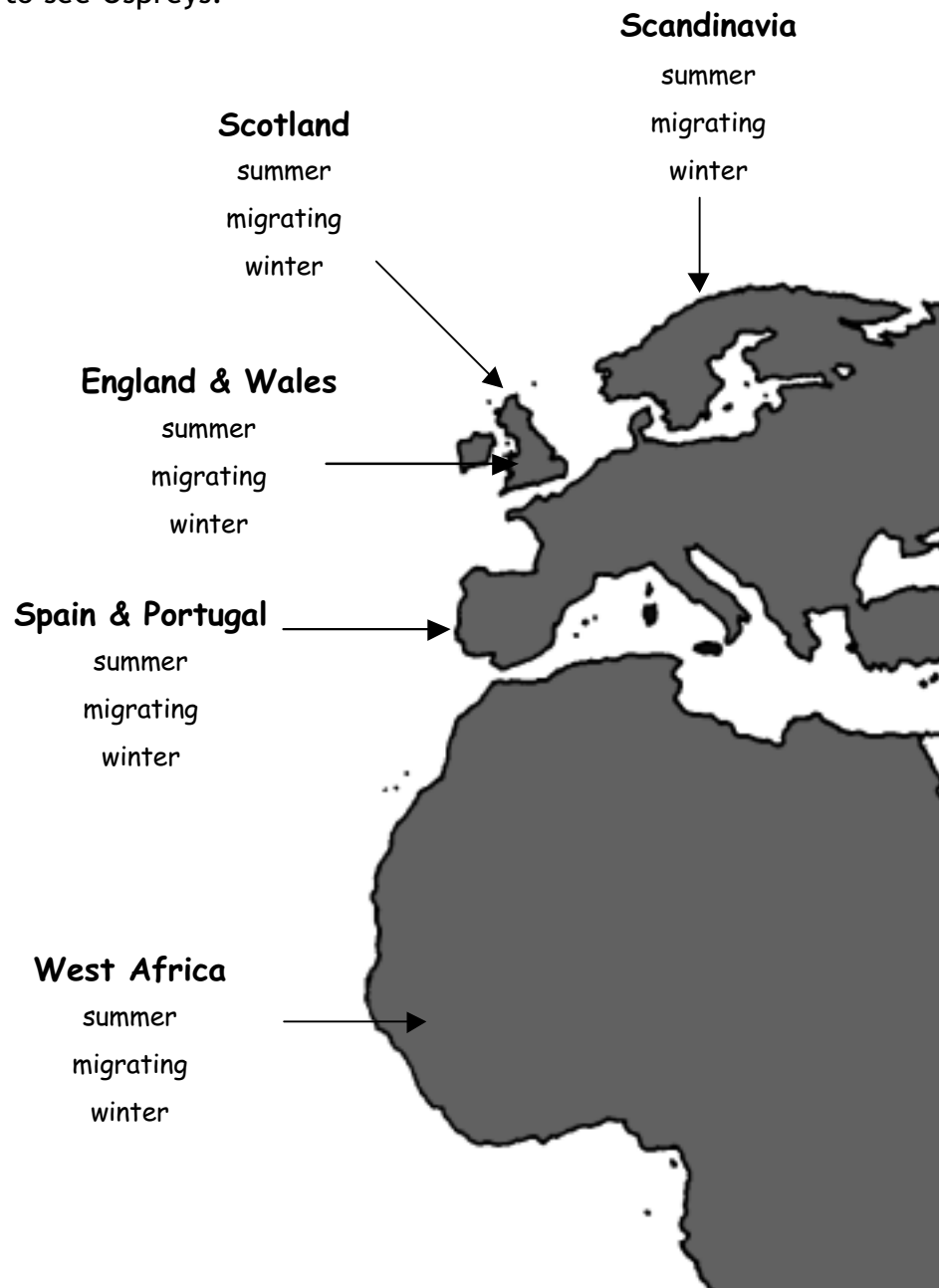
Worksheet - Osprey migration

Below is a map of part of the world where Ospreys can be seen at different times of the year.

You have already learned that Ospreys:

- breed in summer in northern Europe.
- migrate south in the autumn.
- spend the winter in much warmer countries.
- migrate back north in the spring.

For each of the countries or parts of the world shown below, circle when you might expect to see Ospreys.





Activity 10 - The Life Cycle of the Salmon

The life cycle of the Tweed Salmon begins in the autumn of each year. This is when the **adult** Salmon breed in the rivers burns of the River Tweed catchment in a process called redding.

The female fish, called a hen chooses a shallow, fast flowing area in the river or burn. She digs a hollow in the gravel with quick movements of her tail fin.

The male fish, called a cock, moves along beside her as she lays her **eggs** in the hollow. He fertilises them with a substance called milt. The female then covers the eggs with more gravel. This gravel nest is called a **redd**, and making it is called **redding**.

The eggs will remain in the gravel until the spring of the following year when they begin to hatch. These tiny fish still have the egg yolk attached to their stomachs, which they use as food. At this stage they are called **alevins**.

They remain in the gravel for a few weeks until their food supply is almost used up. Then they emerge into the burn or river and begin to feed on the insect larvae that live there.

At this stage these young fish are called **fry**. In the next few weeks most of the fry will die, as there is not enough food and space for them all. Those that survive continue to grow through to the summer of the following year when they become known as **parr**.

After one, two or even three years in the burn or river, the fish change colour to silver. They leave their home burns to begin the journey down the Tweed to the sea. At this stage they are called **smolts**.

This migration takes place in the spring. Groups of fish called shoals, travel together near the surface of the water. They leave the River Tweed and begin the long journey to the North Atlantic Ocean to feed.

The young Salmon feed on other small fish such as sand eels and sea creatures such as shrimps. They can double their weight in a year. After one, two or even three years feeding in the sea, the adult Salmon feel the urge to breed and begin the long journey back to the Tweed where they were born.

Once the fish reach the coast they find the Tweed river by its smell. Then they swim upstream searching for the same river or burn in which they were born.

After a few weeks in their own river, the adult Salmon become much darker in colour in preparation for breeding. The male fish develops a hooked bottom jaw called a kype. This is used for fighting with rival male fish.

Once the male and female fish have paired up in the autumn, the process of spawning begins and the life cycle for the Tweed Salmon begins once more.

Many of the **adult Salmon** die after breeding but some survive and try to return to the sea. These are known as **kelts**.



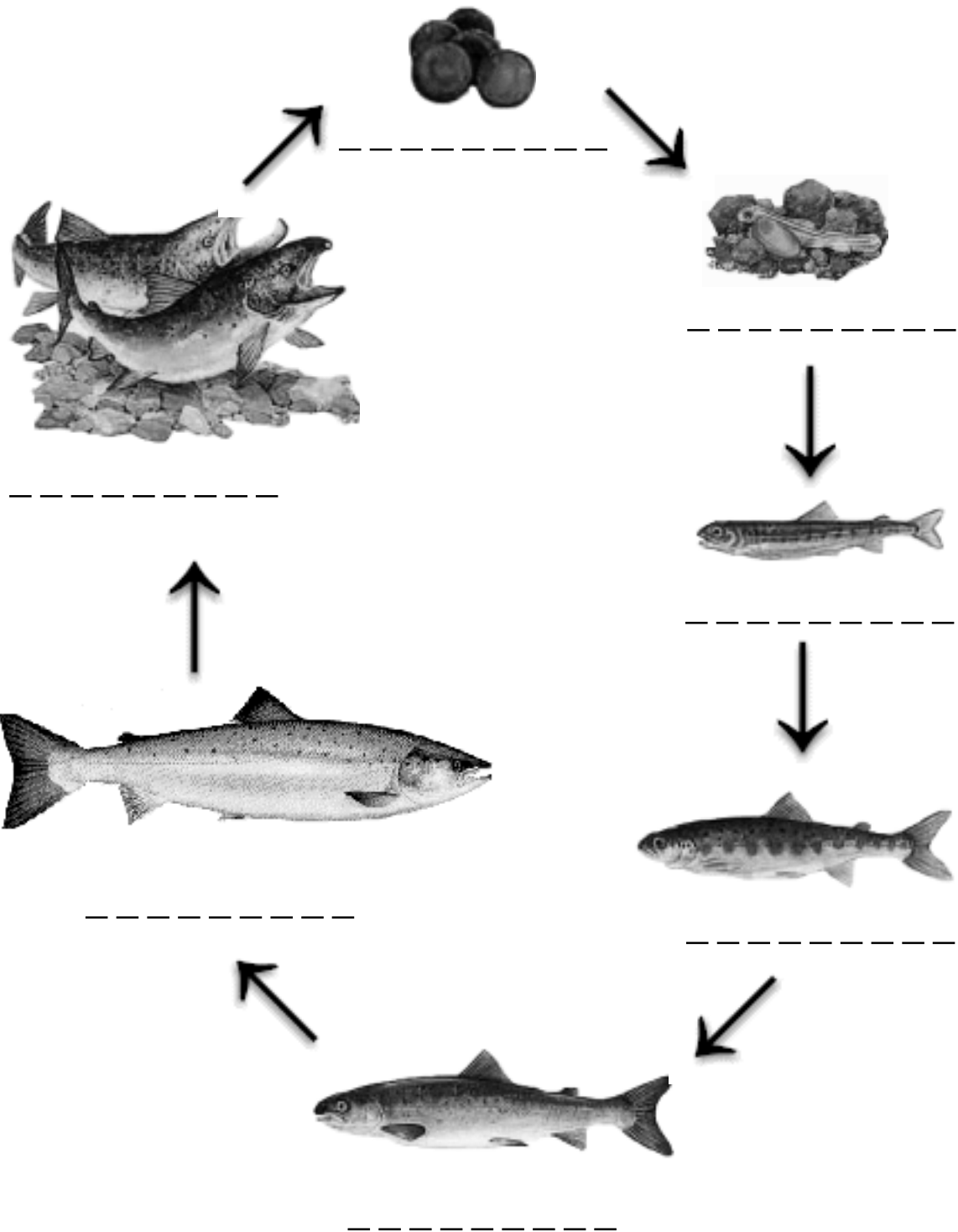


Activity 10 - The life cycle of the Salmon

Worksheet - Salmon life cycle

Here are the stages in the life cycle of the Salmon.

From the information on page 37, fill in each of the stages shown below.
The words you will need are at the bottom of the page.



adult eggs parr redding alevin smolt fry













Activity 11 - Osprey, Salmon and Food

Worksheet - food for survival - Ospreys

Here are some animals that live in the same habitat as Ospreys.

Try to find out what sort of food they eat.

	type of foods it eats		type of foods it eats
 osprey	 goshawk
 siskin	 roe deer
 crossbill	 red squirrel
 fox	 vole

On the next page there are some questions about these animals and how they live and feed.





Try to answer these questions about the animals that live in the same habitat as Ospreys.

1. Why must Ospreys migrate to a warmer place in winter?

.....
.....
.....

2. Name two of these animals that mainly eat plants.

.....
.....

3. Name two of these animals that mainly eat animals.

.....
.....
.....

4. Name two of these animals that eat both plants and animals.

.....
.....

5. Which two of the birds live mainly on seeds?

.....
.....

6. Name two of these animals that might feed on voles.

.....
.....





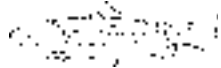







Activity 11 - Osprey, Salmon and Food

Worksheet - food for survival - Salmon

Here are some animals that live in the same habitat as Salmon.

Try to find out what sort of food they eat.

	type of foods it eats		type of foods it eats
	
salmon	dipper
	
brown trout	heron
	
pike	mallard duck
	
minnow or 'baggie'	otter

On the next page there are some questions about these animals and how they live and feed.





Try to answer these questions about the animals that live in the same habitat as Salmon.

1. Which one of these animals migrates to the sea to grow into an adult?

.....

2. Name two of these animals which can live in both fresh water and the sea.

.....

.....

3. Name three of these animals that might eat the minnow.

.....

.....

.....

4. Name two of these animals that eat both plants and animals.

.....

.....

5. Which of the birds eats mainly fish?

.....

6. Which of the birds eats mainly river invertebrates (minibeasts)?

.....





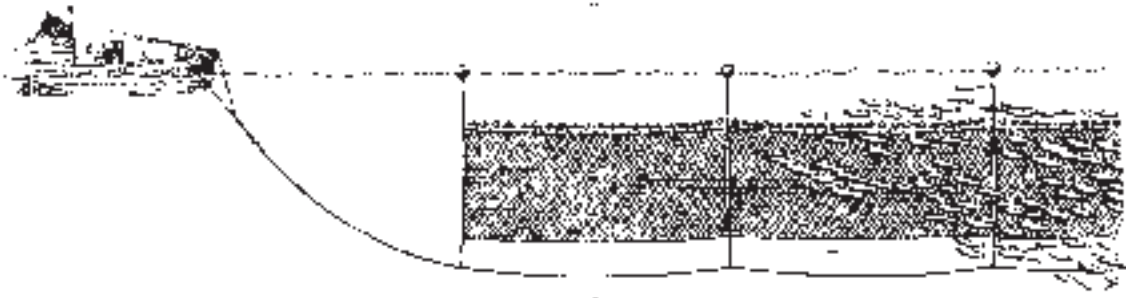
Activity 12 - Salmon fishing - past and present

Today, Salmon are common in the River Tweed system.

We have already seen that the main reasons for increased Salmon numbers in the Tweed have been the removing the obstacles to Salmon migration and cleaning up river pollution.

This activity looks at fishing methods and how the changes in these methods have also helped to increase the numbers of Salmon in the river.

Fishing at Sea



At sea, Salmon are usually caught when they return to the river to breed. They navigate by following the coast, swimming in shoals close to the shoreline.

Boats set out long drift nets which hang down from buoys and the fish are caught when they get tangled in the nets.

Although fishing in this way has never been legal in Scotland, it is still carried on in the North East of England.

In 1992 there were 142 fishermen licensed to catch fish by drift netting.

By 2005, this was reduced to 58 licensed fishermen who caught 42,000 fish.

In 2006, this has been reduced further to just 16 fishermen and it is estimated they will catch about 10,500 fish.

It is expected that there will be no drift netting by 2007 in English waters. This means that many more Salmon will survive to enter the Tweed and other rivers of eastern Scotland.

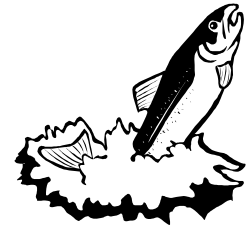
This method of fishing is still very common in Ireland. Many of the Salmon caught in this way in Irish waters are fish that are making their way to the rivers of the west coast of Scotland. However, the Irish government has said that it will phase out drift netting very soon.





Net Fishing from the Shore

Another way of catching the fish is from shore based netting stations. Some of these are on the seashore and others are in the lower stretches of the river.



The fishermen know there are Salmon in the river when they see them jumping. Using a small boat called a coble, the fishermen row out trailing a long net behind the boat.

The net is then brought back to shore and pulled in. Any fish that are encircled by the net are caught.

There is now not so much of this type of fishing as there was in the past.



River Fishing by Rod and Line

There are three legal methods used, either by "bait fishing", "spinning" or "fly-fishing", these last two using an artificial lure to attract the salmon.



The method used depends on the part of the river being fished, the time of year and sometimes how much water is in the river. In certain parts of the river, only fly-fishing is ever allowed.

When **bait fishing**, the fisherman casts a bait such as a worm on a hook into the river in order to attract the fish. This method of fishing for Salmon is now only allowed above the 'gateway' caulds on the tributaries of the Tweed.

These are the first caulds that the fish meet when entering the tributary from the Tweed.



Spinning involves fitting a lure on the end of the line, casting the line into the river and then reeling it back in. As the line comes in, the lure spins and the fisherman hopes that it will attract a fish thinking that the lure is food.



When **fly-fishing**, the fisherman fits an imitation fly to the end of the line and casts it into the water.

The fly is then allowed to float down with the current and again the fisherman hopes it attracts a fish.



The sport is in catching the fish.

Fresh Salmon are delicious to eat and fishermen are now much more careful to keep only the best fish for eating. The others they will release back into the river as they realise that a "stale" fish is more useful breeding in the river than as a not-so-nice meal.





Activity 12 - Salmon fishing - past and present

Worksheet - Here are some questions about Salmon fishing.

Put a tick in the box you think is right answer.

1. How many fish did the drift netting fishermen catch in 2005?

22,000

42,000

62,000

2. How many drift netting fisherman are there now compared to the 1990s?

Less

The same

More

3. In 2006, drift netting for Salmon is illegal in which country?

Scotland

England

Ireland

4. What is the name of the small rowing boat used by the shore based net fisherman?

A trawler

A drifter

A coble

5. What type of lure does a fly-fisherman put on the end of his line?

A spinner

A real fly

An artificial fly





Osprey and Salmon Education Pack

Resources to support the
5 - 14 Environmental Studies Curriculum

Notes for Teachers



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Osprey and Salmon - Notes for Teachers

CURRICULUM FOCUS: Science/Social Subjects

LEVEL: C/D

These notes should be read alongside:

Section 1	Topic Overview
Section 2	Activity Sheets and Worksheets
Section 4	Background Information on Ospreys and Salmon

The aim to these notes is to suggest some teaching points that may be relevant when covering the activities.

Learning Outcomes 1 and 2

Activity 1 - Rare, Endangered and Extinct (page 6)

L01 Some animals are very rare and only a small number of a particular species exist.

L02 Some animals only exist in a few very specialised habitats.

Teaching points

The main aim here is to establish the difference between the idea of an animal species being 'rare' and it being 'endangered'. Just because an animal is rare, it does not mean that it is necessarily endangered. The question here is - does the species have a sustainable breeding population?

When considering the term rare, we must distinguish between animal species that are naturally rare and those that are unnaturally rare.

Naturally rare species never become common because they are limited in numbers by being top predators or needing very specific environments.

One example is on many of the Galapagos Islands, there are species of finch that exist nowhere else. To this end they are very rare, being isolated to that one island. However, as they all live on the one island, their breeding population is secure. Obviously if for some reason the climate or habitat of the island changed suddenly, the particular species may become extinct in a very short space of time.

Similarly, Giant Pandas are rare simply because they have such a specialised habitat and food requirement. However, in addition to being rare, they are also endangered. This is because of man's activities, in this case destruction of the bamboo forests for agriculture. The individual populations have become separated so that there are insufficient numbers in any one group to sustain a viable breeding population.





Unnaturally rare species are those that are rare due to man's activities such as pollution or persecution. Perhaps a better word to describe these animal species is "scarce".

Salmon in the Tweed would certainly have fitted into this category in the late 19th and early 20th centuries.

Without man's adverse influences, Salmon would always have been common in most rivers in Britain.

This is also the case of the Osprey, which although it has made a comeback by recolonising parts of Britain in which it formerly lived, its status can be considered as both rare and endangered as the overall breeding population is still low.

One word of warning, the example given of extinction is of the dinosaurs. Whilst mention of these animals is perfectly valid, this must not be used as an excuse for a 'dinosaurs' topic however keen the children may be!

Learning Outcome 3

Activity 2 - The decline and re-colonisation of the Osprey (page 8)

L03 Some animals that were once locally extinct have re-colonised their former habitat.

Teaching points

We are now looking at the specific time-line that led to the extinction of the Osprey in Britain and its gradual re-colonisation by both natural and man influenced processes.

This is a chance to introduce the concept of a time line and there is also the opportunity to look at some of the social changes in Britain that allowed the Osprey to become extinct but then encouraged its re-colonisation.

There is an opportunity here to mention the changes in attitude towards wildlife that have occurred over the last 150 years or so.

In the 18th and 19th centuries, Ospreys were seen as vermin and were persecuted to extinction in Britain because they were seen as competition with man for food - the Salmon.

Now, they have the highest level of protection of any bird species in Britain.

The worksheet looks specifically at the re-colonisation success in the Scottish Borders.





Learning Outcome 4

Activity 3 - The recovery of Salmon numbers in the Tweed (page 13)

L04 Some animals that were once scarce are now common.

Teaching points

This activity looks at the specific time-line that led to the crash in the numbers of Salmon in the Tweed in the second part of the 19th century. It then goes on to look at the measures that have been taken in more recent years to allow the recovery in Salmon numbers to their present healthy level.

There is a strong social issue in this activity in that the reasons for the decline of the Salmon were largely due to the relatively uncontrolled development of the infrastructure of the textile mills, associated pollution and to a lesser extent overfishing.

Indeed it mirrors many of the environmental issues today between the needs of man and our responsibility to protect the environment.

Considering the development of the textile industry in the 19th century, the caulds that were built to supply the mills with water should have been built with fish ladders. The law then was quite clear about that. However, the law was widely ignored, possibly because in some cases, fish could get over the face of the cauld in high water. However, partial barriers can become total barriers if the water flows are not right at the right time of year.

Some caulds, e.g. Kelso, date back to the early Middle Ages and predate the legislation about fish passes.

The point to be made here is that laws have no value if not enforced.

Whilst mention of these social issues is essential, the thrust of the topic should be on the effect on the Salmon and not allow this to become a topic on the growth and decline of the textile industry.





Learning Outcome 5

Activity 4 - Environmentally friendly products (page 17)

L06 The use of environmentally friendly industrial products/processes can help protect wildlife.

Teaching points

There might be a tendency here to head off on a recycling topic. However, the aim is to show that many man-made products, if not disposed of correctly, can become a hazard for hundreds or indeed thousands of years.

Many animals die from ingesting or getting trapped in plastic and other man-made products. The emphasis should be to encourage the use of recyclable products or packaging and products that are biodegradable.

SAFETY WARNING: the worksheet on household products should only be tackled under adult supervision.

Apart from the obvious safety implications, the children may require help in interpreting labels, as there does not appear to be any consistency as to how the safety information is given. An alternative here might be to bring a selection of products into the classroom and look at them there.

Learning Outcome 6

Activity 5 and Worksheet - Protected Species (page 20)

L06 The legal protection of animal species can greatly increase their chance of survival.

Teaching points

This activity looks at the ways in which Ospreys die, both naturally and as a result of man's activities. It then looks at whether legal protection can reduce or indeed prevent some of these deaths by the imposition of legal constraints on man's activities.

It also touches on the fact that the legal protection afforded to Ospreys in this country does not apply in other countries that the Osprey lives in or passes through on its annual migration.

This subject is very topical in that reports of egg thefts from the nests of Ospreys and other birds of prey occur regularly in the press. Indeed, there was a report in August 2006 of the death of an egg collector when he fell from a tree trying to get eggs from a Sparrowhawk's nest. This might indeed be an area for a piece of personal research by the pupils and can form the basis of one of the related assessment activities.

For more information see the RSPB website www.rspb.org.uk





Learning Outcome 7 and 8

Activity 6 - How human activity affects wildlife (page 23)

L07 Industrial development and associated structures can adversely affect the natural life cycle of a species.

L08 Man-made pollution can cause devastating effects on wildlife

Teaching points

We are now looking at the effect that human activity can have on animal life.

The emphasis for this part of the topic is:

1. The industrial structures - caulds - that prevented Salmon from accessing the upper reaches of rivers in order to breed.
2. The discharge of human sewage and effluent from the textile mills into the rivers in the 19th century grossly polluted much of the middle and lower reaches of the Tweed river system and the effect it had on the Salmon.

The quotes on Page 24 are from less than 100 years ago and there are many elderly people in the Borders than can still remember the colours of the rivers at that time.

The emphasis here should be to stress on the children what sort of Tweed they would prefer to live beside - the old or the new. Things can and do get better.

There are some excellent websites on pollution and other environmental issues that you may wish the children to visit to get more information.

Here are some to start you off:

www.earthlife.net	Children's site for environmental issues
www.kidport.com	Children's site for environmental issues
www.abcbirds.org/pesticides	Pesticides and Birds campaign
www.encarta.com	Encarta atlas (you may have this on CD-ROM in your school)
www.yptenc.org.uk	Young people's trust for the environment

This part of the topic is excellent for individual or group research.





Learning Outcome 9

Activity 7 - Nature Reserves for Wildlife (page 27)

L09 The provision of wildlife/nature reserves can maintain the biodiversity of a habitat.

Teaching points

The ideal way to tackle this is to visit a local nature reserve if one exists. You may also have an area within your school grounds set aside as a wildlife area.

The aim is to establish that all animals need certain things for survival - food and water, shelter and a suitable habitat in which to live and breed.

Very often in our daily activities, we are removing one or more of these requirements and so an animal will not be able to survive in that area.

There are two Osprey Watch Centres and one Salmon Viewing Centre in the Scottish Borders. These are supported by a Community Wildlife Officer who will help with school visits.

Osprey Watch Centres

There are Osprey Watch Centres at Glentress Forest and Kailzie Gardens, both near Peebles.

Contacts:

Glentress Osprey Watch Centre

Tel: 01750 721120
Website: www.forestry.gov.uk/tweedvalleyospreys

Kailzie Gardens Osprey Watch Centre

Tel: 01721 720007
Website: www.kailziegardens.com

Salmon Viewing Centre - Philiphaugh Estate near Selkirk.

Contact:

Philiphaugh Estate Office Tel: 01750 21766

Tweed Forum - Melrose Tel: 01896 849723

An alternative is to arrange for a visit from the Community Wildlife Officer to your school who can give an illustrated talk about the wildlife and the importance of designated wildlife reserves.





Learning Outcome 10

Activity 8 - Biodiversity (page 32)

L010 The biodiversity of an area is dependent on the quantity and range of resources (food, water, shelter etc.) found within the area.

Teaching Points

Biodiversity (a shortened version of biological diversity) is a measure of the variety of the Earth's animal, plant and microbial species. It is a new phrase, which appeared in 1992 at the Earth Summit in Rio de Janeiro, Brazil.

On a world-wide scale, it is important to monitor populations to ensure that species do not die out unnecessarily.

A large biodiversity ensures ecological stability and is a resource for research into new drugs and crops.

Biodiversity should not be confused with biomass.

Biomass is the actual amount by weight (or mass) of living things in an area.

If you studied an area such as a coniferous forest, you would have an enormous biomass if you weighed all the trees and other plants and animals.

However, as only four or five tree species are used in most coniferous forests and as most of these are not native to Britain, they do not encourage a large population of **different types** of wildlife.

By comparison, an Oak forest could have an equally high biomass but there would be many many more different types of animals and plants in the forest.

For example, there are over 400 different invertebrate species that are solely dependent on native Oak trees.

An Oak forest would therefore have a much greater **biodiversity**.





Learning Outcome 11

Activity 9 - Bird Migration (page 33)

L011 Ospreys migrate annually in order to ensure a supply of food.

Teaching points

The main point of this activity is to establish that animals which have a very restricted diet based maybe on only one type of food are forced must either hibernate or migrate in order to survive.

In the case of birds this involves a migration from their summer breeding area to their winter feeding grounds.

It should be noted that whilst many insect eating birds that nest here in summer will head south for the winter following their food supply, many Scandinavian birds such as water birds or seed eating birds find the winter there too harsh and come to Britain for our relatively mild winter climate.

Osprey are slightly different in that whilst their food source - fish - is still here, it may be unobtainable in an adequate quantity. This is due to rivers or lochs being frozen, or in cold weather the fish will be fairly inactive and lie in the slightly warmer water at the bottom of rivers or lochs rather than swim nearer the surface where the Ospreys can catch them.

Under normal circumstances, the water at the upper levels of a river or loch will be warmer than that below. However, as water cools, it achieves its maximum density at 4° Centigrade. As the water continues to cool, the colder water will now rise to the surface and eventually freeze into ice on the surface at 0° Centigrade .

Some small mammals, reptiles and amphibians that cannot migrate will hibernate for all or part of the winter in order to survive.

The activity also covers the fact that when the birds head south, they are leaving our Northern Hemisphere winter and heading for warm tropical areas. It is very possible that some Ospreys migrate across the equator are therefore technically in the Southern Hemisphere summer.

However, as this concept can be confusing for children, the idea of seasons changing between the Northern and Southern Hemispheres has been omitted.





Learning Outcome 12

Activity 10 - The life cycle of the Salmon (page 37)

L012 The life cycle of Salmon includes a migratory period in order to ensure an adequate supply of food at all stages in that life cycle.

Teaching points

Unlike the Osprey, the migration of Salmon is not annual but occurs once, or occasionally more than once, in its lifetime. The migration from the river where it is hatched to the sea and back is in order for the Salmon to mature into an adult.

Why Salmon do this is a bit of a mystery. Food is not necessarily the reason here as in some places, landlocked Salmon grow to maturity without this migration. There is however no doubt that the supply of food is greater in the sea than in the river.

Much more information on Salmon is given in the Background Information section of this document on pages 61 to 68.

Learning Outcomes 13 and 14

Activity 11 - Osprey, Salmon and Food (page 39)

L013 The more an animal can tolerate changes in its environment, the more likely it is to survive.

L014 The more food sources an animal can feed from, the more likely it is to survive.

Teaching points

Whilst food chains, food webs and food pyramids as such are not covered until level E, this activity starts to look at what eats what in the habitats that both the Osprey and Salmon inhabit.

It will also start to make the children think about plant eaters (herbivores), meat eaters (carnivores), animals that eat both plants and animals (omnivores) and the idea of the interdependence of one on another.

The question may come up about why there are so many plant eaters and relatively fewer meat eaters.

The answer is of course all to do with food supply.

For nature to be in balance, there can only be enough of a type of animal that the available food supply can support. As there is far more plant material in the world, then there will be far more herbivores than carnivores.

This is why some of the top predators are rare - there simply is not enough food to support a large population.





Learning Outcome 15

Activity 12 - Salmon fishing - past and present (page 43)

L015 Control of fishing methods can greatly increase fish stocks.

Teaching points

Despite a massive decline in Salmon stocks in the 19th and early 20th centuries due to man's adverse influence on the environment, this decline has been reversed by good management practices.

Industrial development, pollution and fishing methods took more Salmon from the rivers and sea than nature could replace. The only way to redress this imbalance was to remove the obstacles to fish migration, stop the pollution and change the way we look at fish as a natural resource.

The decline in the number of wild Salmon and the introduction of cheap Salmon from fish farming meant that fishing for Salmon at coastal netting stations was becoming less and less profitable. There was however an enormous demand for access to sport fishing in rivers.

The sporting interests bought out the licences of the coastal netsmen meaning that more fish could enter the river.

This increase in Salmon numbers has not only led to increased rod catches in the river, but far more fish have been able to ascend to the upper reaches of the river system to spawn and so the long term survival of the Salmon is greatly enhanced.

In addition to this, the sport fishermen bring in huge amounts of money into the local economy by way of fishing permit fees, hotel accommodation, restaurant meals and other general shopping.





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Background Information



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OSPREY

Background Information

These notes should be read alongside the Activity sheets and Worksheets.

They aim to fill in some of the answers to questions that are likely to arise or problems that you may encounter

Habitat and Food

Ospreys are found in a variety of freshwater, brackish and marine environments. The most important habitat requirement is the presence of ample supplies of medium-sized fish obtainable near the surface of clear unpolluted water. Several birds sometimes congregate at good feeding sites.

The Osprey is a specialist feeder, relying on medium sized fish, both marine and fresh-water. The bird will fly above the water's surface to locate fish, sometimes gliding and soaring up to 70 metres high.

The exact catching technique varies with the type of fish, but they all involve a nearly vertical plunge dive with wings half-folded and feet thrown forward at last moment. The fish are caught in talons after a dive to a maximum depth of 1 metre. The fish is held head first, like a torpedo, when carried to a perch or to the nest.

The long curved talons and the short spines covering the underside of the toes assist with the capture and holding of the fish. The bird is also able to close its nostrils to stop water getting up its nose during a dive.

Legal status

The Osprey is afforded the highest degree of legal protection under Schedule 1 of the Wildlife and Countryside Act 1981.

It is an offence to intentionally take, injure or kill an Osprey or to take, damage or destroy its nest, eggs or young. It is also an offence to intentionally or recklessly disturb the birds close to their nest during the breeding season. Violation of the law can attract fines up to £5,000 per offence and/or a prison sentence of up to 6 months.

The Nature Conservation (Scotland) Act 2004 widens this protection and provides additional protection for the Osprey in Scotland.





Nesting behaviour

Although immature Ospreys may return to the UK, pair up and even build trial nests when they are two years old, they normally breed for the first time in their third to fifth year. Ospreys are believed to be largely monogamous, and strongly faithful both to nest and mate.

The nest, called an eyrie, is generally built on the top of a large tree, usually a conifer, but deciduous trees are also used. In parts of their range, ospreys may nest on cliff ledges, coastal rocks, buoys and electricity pylons. Man-made structures are used more regularly in North America than in Europe, although a small number of the Scottish Ospreys nest on electricity pylons.

These long-lived birds are mainly site faithful and some nests have been in use for some 20 years, with the birds adding to it each year. The nest is a large structure made of branches and twigs, lined with small twigs, moss, bark and grass. It takes both birds 14 to 21 days to complete a new nest, which at completion can be 120 to 150 cm across and 50 to 60 cm deep. As more material is added in later years, the nest can grow to a depth of 150 to 200 cm.

If Ospreys fail to breed successfully, they often start to build a new nest known as a 'frustration eyrie', which they may use for nesting the following year. Ospreys use specially made nesting platforms readily, and many of these sites are in regular use in Scotland.

In the second half of April, the female lays two or three eggs at 1 to 3 day intervals and incubates them for around 35 to 37 days per egg. Even though chicks hatch a few days apart, aggression and dominance by the older chick is rare. This asynchronic hatching is typical for most birds of prey.

If food is short, at least the oldest chick will get enough and survive. Nest failures are most commonly caused by adverse weather conditions, food shortage, inexperience of birds nesting for the first time, and occasionally by egg collectors robbing the nest.

Like most other birds of prey, Ospreys divide the nesting duties clearly between the pair. The female does most of the incubating, brooding and direct feeding of the young. She guards them throughout the nestling period, and will share the hunting at later stages when the chicks are larger. The male, on the other hand, is the major provider of fish for the female and young.

After fledging at about 53 days, both parents provide food for the young, which stay close to the nest for a further two weeks. Many juvenile birds die before they reach maturity at 3 years old. Those that reach breeding age can expect to live on average about 8 years. The oldest known wild Osprey was 32 years old.





Population trends

The Osprey used to be distributed throughout Europe, but heavy persecution, mainly by Victorian egg and feather collectors, during the 19th and early 20th century brought about dramatic decreases and extinctions.

The Osprey became extinct as a breeding bird in England in 1840 and in Scotland in 1916, though it continued to occur as a passage migrant. In 1954 it re-colonised naturally (by birds thought to be of Scandinavian origin) and a pair has nested successfully almost every year since 1959 at Loch Garten, Abernethy Forest Reserve, in Scotland. The Osprey Centre at Loch Garten has become one of the most famous conservation sites in the world.

The early re-colonisation was very slow, possibly because of organochlorine pesticides in the food chain and due to the continued activities of egg collectors, and had reached only 14 pairs by 1976. Fifteen years later there were 71 pairs.

In 2001, 158 breeding pairs were located, mainly in Scotland. That same year saw the first successful nesting of Ospreys in England for 160 years by both naturally re-colonising birds in the Lake District and re-introduced ones at Rutland Water.

Threats and conservation action

In the past, persecution by shooting and nest destruction was one of the main threats, and migrant birds are still occasionally shot in southern Europe, although British Ospreys migrate through Spain where they are at less risk than in some other countries. Contamination of birds with mercury and organochlorine pesticides, and entanglement in fishing line occur, but co-operation with anglers has reduced the latter problem significantly.

Ospreys are surprisingly tolerant of regular activity, such as passing vehicles, but they are extremely nervous of unusual activity, and hence there can be a risk of a nest being deserted following disturbance, both intentional and accidental.

The Osprey is listed on the Amber List of UK birds of conservation concern because of the long-term population decline and since it is a rare breeding bird in the UK.

Conservation action is aimed at increasing the Osprey population and range in the UK. This will require the general land use policies for currently occupied habitat to include a provision for Ospreys and ensure that key feeding and nesting requirements are not compromised. A number of organisations provide artificial nest sites in strategic locations to encourage range expansion.

Protection of the foraging habitat is most effective through coastal zone and estuary management plans, and integrated management of river catchments. Protection of nesting birds from illegal human interference is another priority.





Life Cycle of the Osprey

A young Osprey spends the first seven or eight weeks of its life confined within the nest (or eyrie), a huge pile of sticks lined with moss, bark and grass. It will probably have two siblings and all are fed by the mother who stays in close attendance, tearing into small pieces the fish provided by her mate.

By the age of two weeks the youngsters are able to move around the nest and at a month they are very active, preening and exercising their wings. Gradually the wing-flapping increases until they are able to lift a little off the nest and then take their hesitant first flight.

For at least two weeks after fledging, the young Ospreys return to their nest for food brought in by the adults. Usually the young stay in the area near the nest as they improve their skill in the air and then begin to make attempts to catch fish for themselves in the near locality.

Ospreys look for fish by hovering over the water, although sometimes they are able to use a perch from which to sight their prey. They dive into the water with wings swept back, thrusting their talons forward at the last minute to grab the fish below the surface. Adults are successful about once every four dives, but it takes the inexperienced juveniles many more attempts before they are successful. Ospreys can hunt for fish in both salt and fresh water.

By late August or early September, the young Ospreys leave their nest sites and head southwards. Many of the Scottish birds will have been ringed as chicks before they leave their nests and this has provided much information about their movements. They are fitted with two rings. The larger is a Darvic ring which has big identification letters and numbers and can be read in the field using binoculars. The smaller is a British Trust for Ornithology ring which can be returned to the British Natural History Museum if found on a dead bird.

Young Scottish Ospreys have been identified in this way in the south of England and Wales, Brittany, Spain, Portugal, North Africa and as far south as Senegal and Guinea in West Africa. It is this area where Scottish birds seem to spend the winter, arriving there in October and fishing along the coast and in the mangrove swamps.

Mature adult birds leave West Africa and head north to the breeding areas again in March. Younger birds do not return for several years. Sometimes they return when they are 2 years old, but those that survive do not begin to breed until they are aged 3 to 5 years. Occasionally a pair will build a nest and establish a territory one year, only returning to breed the following year.

It certainly seems to be the case that Ospreys, especially the males, return to breed in the vicinity from which they themselves fledged. This explains the relatively slow expansion of range in Scotland and is why translocation of young birds before they fledge has proved successful in establishing new breeding populations.





Ospreys generally mate for life and the older, experienced birds usually arrive back in the nesting area first with established pairs nearly always returning to their previous nest sites. New pairs must find new sites when they arrive and often have difficulty finding a suitable natural site to hold the nest, which will often be over a metre wide.

They usually choose a site within 3 to 5 kilometres of water and prefer to have an open area around the nest site so as to have easy access when landing. Flat-topped trees such as old "Granny" pine trees are the most likely natural site but Ospreys take readily to man-made structures such as power pylons and radio towers.

In many parts of their range Ospreys have used artificial nests especially if built near water. There are several such platforms now in place across Scotland and other parts of the UK in the hope that these will prove attractive for the young birds when they return.

In Scotland, female Ospreys begin to lay their eggs in late April. The eggs are beautifully blotched reddish-brown and are about the same size as a large hen's egg. They are produced at two-day intervals. Novice breeders will usually lay two eggs; more experienced birds lay three and, just occasionally four.

Both adults will take part in the long incubation process but the female takes the major role with the male providing her with food and chasing away any potential predators.

Until fledging the female stays on or close to the nest, but after the young have fledged she joins the male in bringing food back to the nest site. Ultimately the young become independent hunters and the adults' role as parents and providers is finished.

Some of the Ospreys in Scotland are more than 25 years old. We know this from the large Darvic rings that are fitted on their legs when they are chicks. Years later the ring numbers can be read when they come back to build their nests and have chicks of their own.

On 15/3/2000 an Osprey with ring number M9976 was found electrocuted near Agadir in Morocco. It had been ringed as a chick in Scotland on 20/7/1974 so was over 25 years old - a new longevity record for Ospreys. (This information from the Ringers Bulletin, published by the British Trust for Ornithology.)

However, although some Ospreys live to a ripe old age, not all of them do. In fact, most of the young die before they reach 3 years of age and are old enough to breed themselves.

The information in this section has been edited from information provided by kind permission of the Royal Society for the Protection of Birds.





SALMON

Background Information

The Atlantic Salmon

The Atlantic salmon is an anadromous migratory fish found in the temperate and arctic regions of the Northern Hemisphere.

It is referred to as being anadromous because of its habit of migrating from the sea into fresh waters to spawn. This is the exact opposite of the common eel which leaves fresh waters to spawn in the Sargasso Sea, and is therefore called catadromous.

When we speak of "salmon" we are referring to either Atlantic salmon or Pacific salmon. There is only one species of Atlantic salmon: *Salmo salar*. There are six species of Pacific salmon: pink, chum, chinook, coho, sockeye and masou.

Do all Atlantic salmon go to sea?

Although most Atlantic salmon spend part of their lives at sea there are some which are non-migratory. In several lakes in eastern North America, the Ouananiche or Sebago salmon is a form known as a land-locked salmon, though their access to sea is not barred. In Lake Vänern in Sweden there is a non-migratory form of Atlantic salmon called "blanklax". Land-locked Atlantic salmon also occur in Lake Ladoga in Russia and in Norway in Lake Byglandsfjord.

How big can salmon grow?

Atlantic salmon can grow to a very large size and the biggest, which have reached up to around 70lbs (32kg), are usually caught in Norway and Russia. However, some very large fish have been recorded in Scottish rivers. It is generally accepted that the largest one caught on rod and line in the UK was taken by Miss Georgina Ballantyne in the River Tay: it weighed 64lbs (29kg). There is an 1891 report of a monster salmon of 70lbs, also caught in the River Tay, but on this occasion in a net belonging to a Mr. Speedie.

Do Atlantic salmon have a world-wide distribution?

No. Except for the land-locked varieties, they are naturally limited to the waters of countries bordering on the North Atlantic Ocean and Baltic Sea. The following countries presently have Atlantic salmon, in varying numbers: Canada, Denmark, England and Wales, Faeroes, Finland, France, Greenland, Iceland, Ireland, Norway, Poland, Portugal, Russia, Scotland, Spain, Sweden, United States.





Salmon Biology

How do salmon navigate?

Salmon navigation is one of the marvels of nature. While the full answer is not yet clear, a number of mechanisms may guide salmon at sea. These include guidance by the stars as well as use of receptors sensitive to local differences in the earth's magnetic field. Ocean currents may also play an important role. Near the coast and in the rivers, salmon are guided by a chemical memory, which apparently allows them to recognise and home to substances, including pheromones, present in the water in very minute traces.

Atlantic salmon return to their native river with amazing accuracy. Although some may stray to other rivers, the majority ascend their home river to their area of origin.

Can male and female salmon easily be identified?

When they arrive fresh from the sea it is difficult to distinguish the sex of salmon externally. Later the head of the male becomes elongated and grows a protuberance called a "kype" from the tip of the lower jaw. At this stage male and female are easily distinguished.

When do salmon spawn?

Spawning time varies between rivers and may be influenced by the water temperature and amount of daylight. Generally spawning will occur during the period November-December in Great Britain and Ireland but may extend from October until late February in our larger rivers.

Do all salmon die after spawning?

About 90 to 95% of all Atlantic salmon die following their first spawning, but some survive to spawn two or three times: as many as four spawnings have been reported. The survivors, predominantly female, return to sea to feed between spawning.

How many eggs does an Atlantic salmon deposit?

Female salmon in most areas produce 450 to 750 eggs per pound of body weight but the number may rise, for example in Iceland, to 900.

Where are the eggs deposited?

They are laid in a depression called a "redd" excavated by the female fish in the gravel of the river bottom. After the eggs are deposited they are immediately fertilised by an accompanying sea-run male, and often by mature male parr, and then covered with gravel by the female.

The incubation time depends upon the water temperature. Hatching usually occurs in early spring and the young fish (called "alevins") remain in the redd for a few weeks, nourished by the attached yolk sac. When they emerge from the gravel in April or May, they are about 25mm in length. As they grow, the young fish develop prominent markings on their sides and are then known as parr.





How long do young Atlantic salmon stay in the river?

This is dependent upon the water temperature and the availability of food. The length of stay varies very much, from one year in the southern portion of the salmon's range to five or more years in the more northern, colder regions.

When do they leave the river?

The young fish, now called "smolts", leave the rivers during the late spring. Most will be gone by June.

Where do they go?

Smolts are believed to move in schools while heading off to deep-sea feeding areas. While the best-known feeding locations are in the Norwegian Sea and the waters off Southwest Greenland, there are known to be many other sub-arctic feeding areas. Salmon that remain at sea for more than one winter undertake the longest migrations, but grilse - a salmon that has spent only one winter at sea before returning to the river - tend not to travel beyond the Faeroe Islands and the southern Norwegian Sea.

How long do salmon stay at sea?

They remain in the ocean from just over a year to three or four years. Salmon feeding off Greenland generally stay at sea for two or three years.

What are the salmon's natural enemies?

At different life stages, the principal predators of salmon are goosanders and red-breasted mergansers, cormorants, gulls, pike, pollack, cod, sharks, seals and otters.

How high can a salmon jump?

The highest jump a salmon has been known to make in Scotland is a vertical one of 12ft (3.7m) at the Orrin Falls in Ross-shire. The height a salmon can achieve depends upon the relative depth of the water at the foot of the fall and the position of what is referred to in engineering terms as the "standing wave" or hydraulic jump.

What influences the upstream movement of salmon in a river?

A number of factors affect the movement of salmon up the river. In the spring, water temperature is of great importance, and until the water temperature reaches 42°F (5°C) there is little upstream movement of fish over obstacles. Later in the season movement is affected by river flow and climatic conditions.





What are the survival rates at various stages in the life cycle of the salmon?

Stage	No. of Individuals	% Survival
River		
Eggs	5000	---
Alevin/Fry	4700	94
Fry - end 1st year*	360	8
Parr (1+ yrs old)**	140	43
Parr (2+ yrs old)**	77	57
Parr (3+ yrs old)**	39	55

(This leaves on average 52 smolts which migrate to the sea which is approximately a survival rate from egg to smolt of 1%)

Sea	% Survival from smolt stage	
Adults returning to coastal waters as grilse and 2 year old fish	5	10

* 88% of total mortality occurs between March and July.

** A proportion of these migrate to sea as smolts in the spring.

How does one know the age of a salmon?

The concentric rings of the scales of a salmon can reveal the age of a fish. When the young salmon first emerges from the gravel it has no scales, but very soon papillae start to appear along each side and develop quickly into small calcareous plates which, as they grow, lay down rings or 'circuli' at regular intervals.

During periods of rapid growth occurring in the warmer months, when the fish are feeding more actively, the rings are widely spaced. During the winter months when feeding activity is reduced, the circuli are laid down close together, giving the appearance under the microscope of a dark band, known as an 'annulus'.

The annulus is complete by the end of the period of little or no feeding in the winter. Once feeding recommences in the late spring the circuli are again more widely spaced. So by counting the 'annuli' or winter bands, the age of the fish can be determined.





Feeding

Do salmon feed in fresh water?

As juveniles, salmon feed in their native rivers, and after smolting and migration to sea they continue to feed, principally on crustaceans and fish. Adult salmon do not feed in fresh water, although, very rarely, parr have been found in their stomachs at spawning time.

What do parr feed on when they are in fresh water?

The larvae of aquatic insects and other aquatic invertebrates together with terrestrial insects which fall into the water.

What do salmon feed on in the sea?

The salmon feed on a variety of small fish including capelin, herring, sand eels and sprats and the larger animals found in plankton, especially surface-living crustaceans.

Diseases

Do diseases or parasites attack wild salmon?

Salmon, both in the wild state and in fish farms, are vulnerable to bacterial and viral diseases, and also to infestation by parasites, particularly sea lice.

A common bacterial disease is Furunculosis. The furuncles or boils, which are usually fatal, are most likely to appear in wild fish in warmer months when river levels are low and fish collect in pools while waiting for more water to allow their upstream journey to continue. It has been controlled in salmon farms by vaccination.

Ulcerative Dermal Necrosis (UDN) was rife among wild fish in the late 1960s and early 1970s. Although the causative organism has never been identified, it was almost certainly a virus. It showed itself first in the appearance of small bleached areas on the head, back and tail, which were then covered in a slimy bluish-grey growth. The affected areas were vulnerable to ulceration and infection by fungus.

Infectious Salmon Anaemia (ISA) is another viral disease to which wild fish are vulnerable; it has been endemic for some years in salmon farms in Norway, and was first detected in a number of Scottish farm sites in 1998.

Sea Lice, which can only survive in salt water, are naturally occurring parasites whose presence in small numbers indicates that a salmon in the river is fresh from sea. However, they multiply exceedingly when large numbers of farmed salmon are concentrated in sea cages, and can infest wild salmon smolts encountering them in inshore waters during their seaward migration, with highly damaging results. Sea trout smolts and adults are even more seriously affected because, unlike salmon, they spend much of their life at sea close inshore.





Salmon Farming

Is the growth of salmon farming significant for wild salmon stocks?

Farmed salmon production in the North Atlantic area has increased dramatically, particularly in Norway, but also on the west coasts of Ireland and the Scottish Highlands.

A number of problems have resulted, which include:

- High concentrations of sea lice - these multiply in the confined conditions of sea rearing cages. As explained earlier, migrating sea trout and salmon smolts can be very vulnerable to attack by these lice. In some rivers, wild stocks have virtually collapsed.
- Escapes of farmed fish - which are known to be able to interbreed with wild fish. Since stocks in individual rivers are locally adapted to optimise their survival, this interbreeding has been shown to reduce the fitness of wild stocks for their local environment.
- Pollution of the water environment - by uneaten food, fish faeces, or medications used to treat farmed salmon in their cages.
- The risk of the spread of disease or parasitic infestation - such as Infectious Salmon Anaemia and Gyrodactylus salaris.

Can anything be done to counter these problems?

Codes of best environmental practice are being developed and improved.

These include use of the principle of integrated sea lice control, through co-ordinated fallowing within sea lochs and bays to break the cycle of sea louse survival, followed by co-ordinated treatment to prevent cross infestation. Legislation to enforce these codes is essential.





Threats

What other problems affect salmon stocks?

There are a number of factors which have had an adverse effect on salmon stocks, as shown in detail on the following pages. Some, such as predation by other species, have already been mentioned.

Others include:

- Pollution of rivers and silting up of spawning gravels.
- Obstacles to migration, such as dams.
- The effect of fisheries which inadvertently take salmon (“by-catch”) or which remove the salmon’s natural food in the sea.
- Climatic changes which are affecting the salmon’s ability to grow and survive during its time in the sea.
- High seas and coastal “interceptory” mixed stock fisheries which take fish from more than one river population, thus denying the ability to manage the exploitation of individual river stocks on a local basis to maintain stock levels.

Stocks

How have salmon stocks changed over the years?

All around the North Atlantic, stocks have been in general decline over a number of years. Some stock components, such as early-running or ‘spring’ fish, have suffered particularly badly.

Actual stock levels are difficult to estimate, except on rivers with reliable counting facilities, but catch figures can be used to give an indication, particularly of trends.





Saving the Salmon - The Solution

Conservation action to address seven major issues that affect the salmon during its lifecycle:

1. Inadequate in-river production

- Remove or prevent obstructions or install adequate fish passage.
- Prevent pollution - control the use of water to maintain adequate flow rates and river levels.
- Initiate and continue habitat restoration and enhancement.
- Develop catchment-based salmon management and enhancement policies.

2. The impact of aquaculture

- Develop and enforce strict environmental assessment procedures for new and existing aquaculture sites.
- Specify and enforce permitted effluent and sea lice density levels.
- Exclude new aquaculture sites detrimental to wild salmon and sea trout.
- Develop strategies to remove existing detrimental sites.
- Minimise genetic and other biological interactions between farmed and wild salmon.
- Advance technology to reduce harmful effluent, deter escapes and control disease and parasites.

3. The impact of fisheries targeted against other species

- Institute precautionary management regimes for industrial fishing in the Atlantic salmon's forage areas.
- Research the impacts of industrial fishing on the salmon and its marine ecosystem.
- Research the impact on salmon of pelagic fishing for human consumption.

4. Low marine survival

- Develop and implement tracking technologies, ocean surveys and monitoring to determine salmon movements and feeding at sea.
- Research the direct and indirect impacts of the ocean ecosystem on Atlantic salmon.
- Use these data to develop better predictive models of salmon abundance, in order to facilitate proactive management.





5. The impact of mixed-population fisheries

- Negotiate permanent closure of mixed-population fisheries in territorial waters with fair compensation.
- Negotiate permanent closure of the commercial salmon fisheries of Greenland and Faeroe Islands through compensation, or the development of alternative fisheries.
- Implement an international surveillance system to detect and prosecute unauthorised fishing for Atlantic salmon in international waters.

6. Predation

- Document the effects of bird and mammal predation in rivers, estuaries and the open sea, and develop optimum practicable means of controlling damage.
- In the interim, permit appropriate local or regional measures based on fair assessment of damage.

7. In-river exploitation and management

- Develop and implement catchment salmon management.
- Manage salmon exploitation on an environmentally sustainable basis.
- Conduct population and migration assessment to guide management.
- Implement precautionary regulation of exploitation where needed.
- Develop catch and release as a management tool.

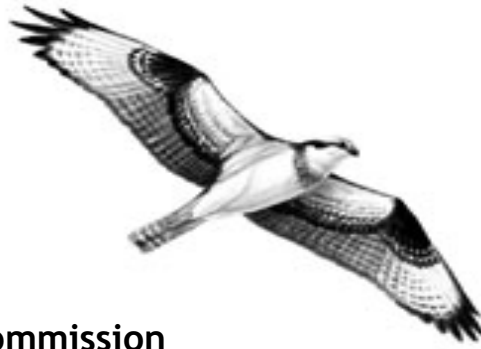
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Appendix 1 - Useful contacts

Osprey



The Forestry Commission

Forest Enterprise

Weavers Court

Forest Mill

Selkirk

TD7 5NY

Tel: 01750 721120

Website: www.forestry.gov.uk/tweedvalleyospreys

Glentress Osprey Watch Centre

Tel: 01750 721120

Website: www.forestry.gov.uk/tweedvalleyospreys

Kailzie Gardens Osprey Watch Centre

Tel: 01721 720007

Website: www.kailziegardens.com

Community Wildlife Officer

Tweed Forum

South Court

Drygrange Steading

Melrose

Roxburghshire

TD6 9DJ

Tel: 01896 849723

Fax: 01896 849129

email: info@tweedforum.com
diane@tweedforum.com

Royal Society for the Protection of Birds

RSPB Scotland

Dunedin House

25 Ravelston Terrace

Edinburgh

EH4 3TP

Tel: 0131 311 6500

email: rspb.scotland@rspb.org.uk

Website: www.rspb.org.uk





Other Osprey Watch Centres

Loch Garten Osprey Centre Abernethy

Tel: 01479 831476
E-mail: abernethy@rspb.org.uk
Website: www.rspb.org.uk/reserves/guide/l/lochgarten/index.asp

David Marshall Lodge Queen Elizabeth Forest Park Aberfoyle

Tel: 01877 382383
E-mail: cowal.trossachs.fd@forestry.gsi.gov.uk
Website: www.forestry.gov.uk/forestry/INFD-6E4JVF

Scottish Wildlife Trust Loch of the Lowes Reserve Dunkeld

Tel: 01350 727337
Website: www.swt.org.uk/wildlife/lochoflowes.asp

Dumfries and Galloway Council County Buildings Wigtown

Tel: 01988 402673
E-mail: ospreys@dumgal.gov.uk
Website: www.dumgal.gov.uk/dumgal/miniweb.aspx?id=193





Salmon



The Tweed Foundation

The Tweed Fish Conservancy Centre
Drygrange Steading
Melrose
Roxburghshire
TD6 9DJ

Tel: 01896 848271
Fax: 01896 848277
email: info@tweedfoundation.org.uk
Website www.tweedfoundation.org.uk

Tweed Forum

(also the contact for the Community Wildlife Officer)

South Court
Drygrange Steading
Melrose
Roxburghshire
TD6 9DJ

Tel: 01896 849723
Fax: 01896 849129
email: info@tweedforum.com
diane@tweedforum.com
Website www.tweedforum.com

Philiphaugh Salmon Viewing Centre

(Educational contact - Community Wildlife Officer - Tweed Forum)

Philiphaugh Estate
Selkirk

Tel: Philiphaugh Estate Office 01750 21766
Tweed Forum 01896 849723

Environmental websites for children

www.earthlife.net	Children's site for environmental issues
www.kidport.com	Children's site for environmental issues
www.abcbirds.org/pesticides	Pesticides and Birds campaign
www.encarta.com	Encarta atlas
www.yptenc.org.uk	Young people's trust for the environment





Appendix 2 - Osprey pictures



Female Osprey and young



Osprey chick on the nest



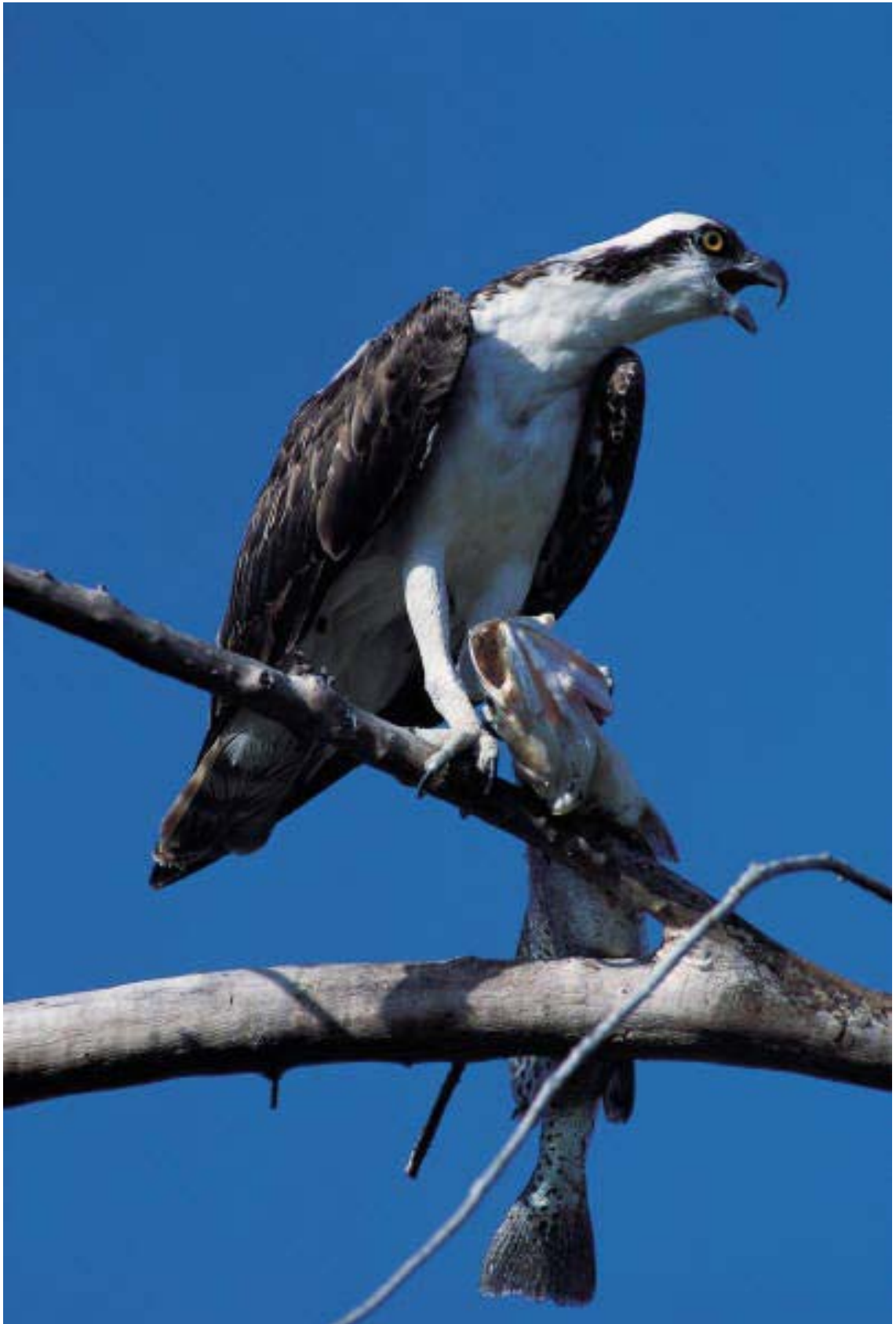


Female Osprey on the nest



Female Osprey with chick





Adult Osprey with fish





Appendix 3 - Acknowledgements

The preparation of this education pack was only made possible with the valuable assistance of the following.

Special thanks for proof reading and for additional information:

Ospreys	Sarah Oakley	Community & Environment Ranger Forestry Commission
Salmon	Dr. Ronald Campbell	Senior Biologist - Tweed Foundation

Thanks also to:

Tim Barratt	Tweed Forum
Diane Bennett	Community Wildlife Officer
Fiona Crouch	Bridging the Border Education Project
Peter Gordon	RSPB

Pictures were supplied by:

The Forestry Commission - Forest Life Picture library
The Royal Society for the Protection of Birds
Tweed Forum
David Warburton

Background information was supplied by:

The Royal Society for the Protection of Birds
The Atlantic Salmon Trust

Main text and editing:

David Warburton

Published by: Tweed Forum - September 2006



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