



Learning about DRAGONFLIES

**British
Dragonfly
Society**



Dragonfly

Information Pack



Based on the Dragonfly Information Pack by The Dragonfly Project.

Recreated with kind permission from Ruary Mackenzie Dodds, Kari de Koenigswarter and previous contributors.

Edited by:

Fiona McKenna and Eleanor Colver.

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Foreword

One of my very best wild encounters as a young nature spotter has to be watching dragonflies. Coming from the Midlands, I spent a huge amount of time at an amazing wild place close to my home called Cannock Chase. Famous for its Adders and Nightjars, the reserve also had lots of ponds, which were humming with dragonflies in summer, and I particularly remember one visit during the long school holidays. With the sun beating down, I'd been made to wear a cap by my mum and dad to make sure I didn't get burnt while watching the action from one of the ponds.



As squadrons of damsels and dragons zigged and zagged across the water, one dragonfly decided the best place to take a break was on the brim of my cap. Thrilled by this close encounter, I sat there for a moment taking it all in, before then chancing my arm to see if I could encourage it onto my hand. And lo and behold it just strolled straight on to my finger like it owned the place!

Flying in our skies for over 300 million years, dragons and damsels are living breathing dinosaurs - in miniature! And watching these high-energy predators chasing down their flying food is every bit as exciting as spotting the world's fastest bird, the Peregrine falcon, stoop after an unsuspecting pigeon. But dragonflies are much more than just beasts, as anyone who has marvelled at the stained-glass wings will agree, they're also beauties too. But, for me, the most amazing fact of all is that their time as winged dragons marks very much the last chapter of a life mostly spent below water. Emerging out of the water only to find love, all dragons and damsels spend over 90% of their lives in an aquatic nursery, murdering and mashing anything that crosses their path!

Hopefully this information pack will be your springboard into the wonderful world of dragonflies and damselflies. So all you need to do now is to pick a warm day, find some water and then sit back to watch the free entertainment on offer, as these wonderful, winged beauties won't let you down.

A handwritten signature in black ink that reads "Michael Dilger". The signature is written in a cursive style with a large, stylized initial 'M'.

Mike Dilger, Naturalist, TV Presenter and proud Patron of the
British Dragonfly Society.

Introduction

Dragonflies are colourful, unusual and fascinating but they can also tell us a lot about the importance of conserving biodiversity and looking after our environment. They need both clean freshwater and terrestrial habitats to thrive. This makes them the perfect subjects to study as they can tell us a lot about the overall health of our environment.

They are amongst the oldest, fastest and largest of our insects and were flying even before the dinosaurs were around! They are not only beautiful, have wonderful aerobatic skills and a fascinating life-cycle but they are very beneficial to humans too. Adult dragonflies consume large numbers of biting insects such as mosquitoes, midges and other flies that can carry diseases such as Dengue Fever — a dangerous tropical disease.

This information pack is intended for children 10 years+ and teachers with no prior knowledge of dragonflies and damselflies. It offers practical teaching ideas and activities. It will inform both children and adults of the threats that face dragonflies and damselflies and the consequences of these threats to everyone's future. It also outlines what can be done to help these iconic insects to thrive.

Materials needed for activities have been listed at the top of each worksheet, no specialist equipment is needed.

Further resources:

Books:	<ul style="list-style-type: none">• Britain's Dragonflies, A field guide to the damselflies and dragonflies of Great Britain and Ireland Fourth Edition. By Dave Smallshire and Andy Swash.• Field Guide to the Dragonflies & Damselflies of Great Britain and Ireland. By Steve Brooks and Steve Cham, illustrated by Richard Lewington.
Website:	<p>www.british-dragonflies.org.uk</p> <p>A selection of publications can be found on gardening for dragonflies, species identifications guides and lots of information on how to research, record and conserve dragonflies.</p>
Videos:	<p>General overview of dragonflies: https://www.youtube.com/watch?v=edW30jsCy6M&t=72s</p> <p>Dragonfly flight: https://www.youtube.com/watch?v=a8RQV_Dah-8</p> <p>General overview and lifecycle: https://www.youtube.com/watch?v=GczQRnOp-1s</p> <p>Southern Damselfly: https://www.youtube.com/watch?v=J5QW0K-T5Tk</p> <p>Deadly 60 Dragonfly vs damselfly: https://www.youtube.com/watch?v=cC7azw0pAEw</p>
Charts:	<p>'Freshwater Name Trail' and 'Guide to Dragonflies and Damselflies of Britain' by Field Studies Council publications.</p>

Why are Dragonflies and Damselflies so special?

- They are very BEAUTIFUL.
- They DON'T sting!
- They EAT mosquitoes, gnats and midges.
- They are FANTASTIC flyers and they are AMAZING to watch.



Male Banded Demoiselle Damselfly



Male Southern Migrant Hawker Dragonfly

- They can WARN us about WATER POLLUTION.
- They are an IMPORTANT food source for other animals.

What are Dragonflies and Damselflies?

- **Insects** that are in the Order (group) **Odonata**—which means ‘toothed jaws’
- They have large eyes and 2 pairs of wings
- Odonata contains **2 sub-orders**: **Anisoptera**, commonly known as **Dragonflies**, and **Zygoptera**, better known as **Damselflies**
- The term Dragonfly can be used when speaking about both sub-orders

How to tell the difference between a Dragonfly and a Damselfly:

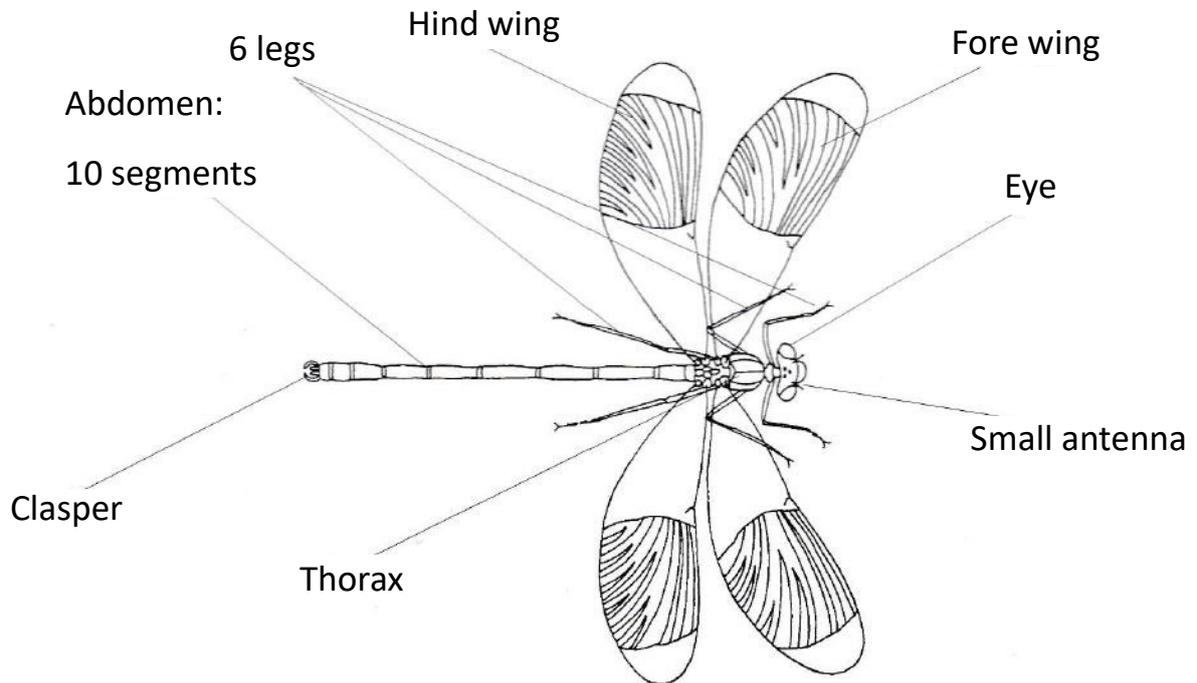
The easiest way to tell the difference is to wait for them to land. If they **fold their wings along their abdomen** (as in the picture below) they are **damselflies**.



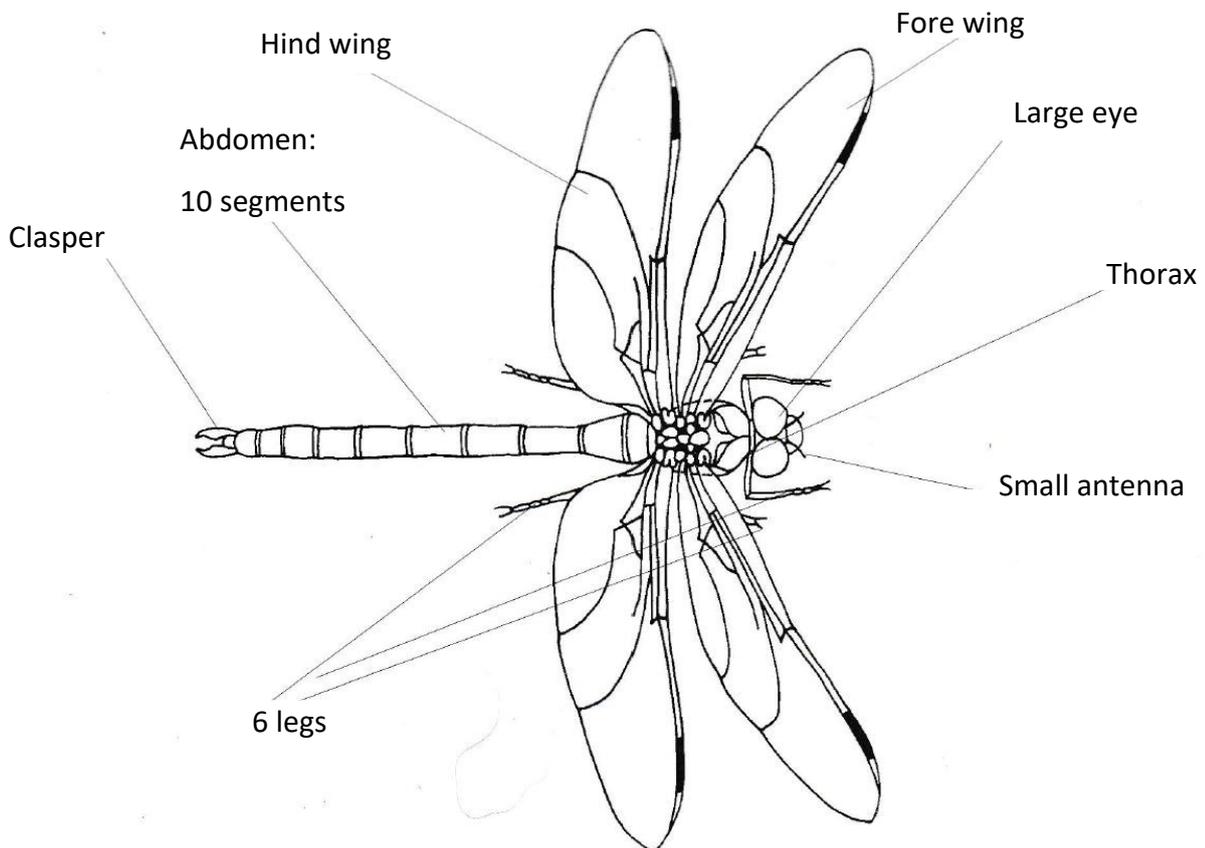
If they leave their **wings out flat like an aeroplane** they are **Dragonflies** (pictured below)



Damselflies are usually smaller, look more delicate and have a weaker fluttering flight than Dragonflies. Their fore and hind wings are also the same shape. See diagram below:



Dragonflies are generally larger and are faster fliers. Their fore and hind wings are different shapes and they have very large eyes that occupy most of their head. See the diagram below:



Worksheet 1:

Dragonfly or Damselfly?

What to do:

1. Look at the photos below—can you tell which is a Dragonfly and which is a Damselfly?

Write 'Dragonfly' or 'Damselfly' under each photo.



2. Write down how you tell the difference between a Dragonfly and a Damselfly:

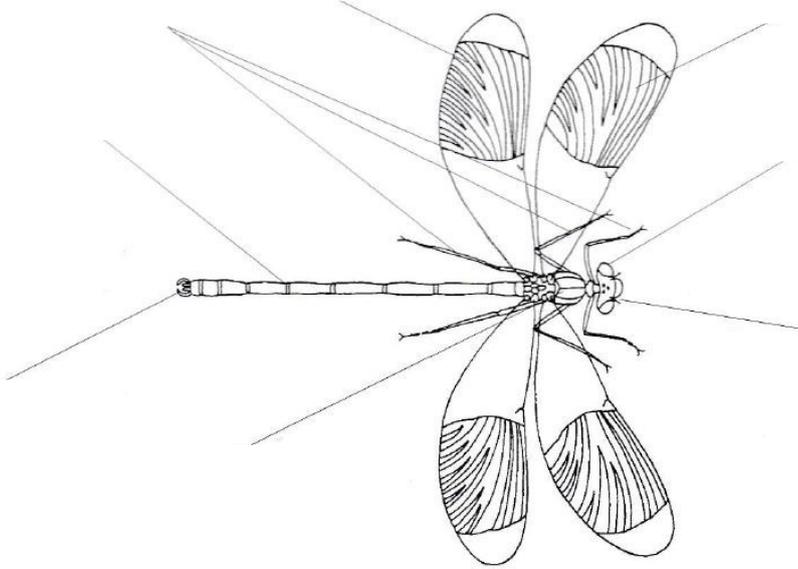
Worksheet 2:

Dragonfly and Damselfly Body Parts

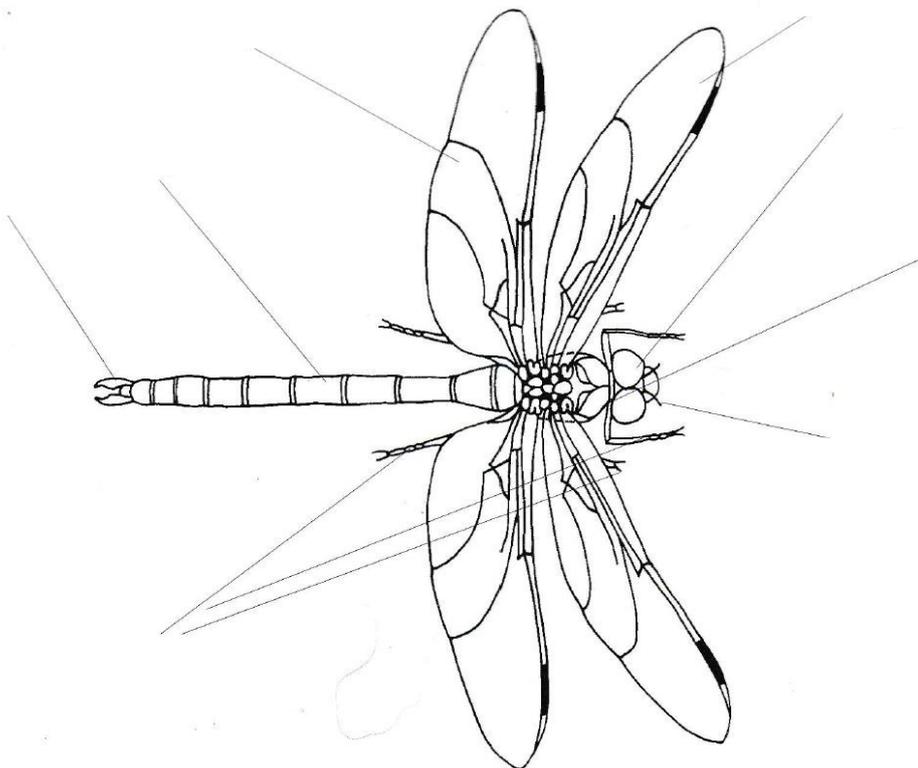
What to do:

Look at the diagrams on page 7, now fill in the names of each body part below:

Damselfly



Dragonfly



How Old Are They?

Fossils clearly recognisable as Dragonflies and Damselflies have been found in rocks from the Carboniferous period, which were laid down over 300 million years ago!



They are amongst the largest flying insects ever to have existed. One group, Meganeuridae, had a wingspan that reached 71 cm, making them the largest flying creatures of their time.

Why did these huge dragonflies disappear? We do not know for sure. However, we know that they disappeared around the same time that oxygen levels in the atmosphere dropped. Insects don't have lungs, or blood vessels for carrying oxygen around the body like humans do. Instead they just have a simple system of tubes (called tracheae), which is not as effective as the human respiratory system at delivering oxygen. When oxygen levels in the atmosphere dropped, the simple respiratory system in these large insects may have failed as there simply wasn't enough oxygen to sustain their needs.

How Many Species Are There Now?

Nearly 6000 species are known in the world today. Slightly more than half are Dragonflies, the rest are Damselflies. The majority of species live in the tropics, but we have over 40 breeding species in Great Britain.

Worksheet 3:

Draw and colour a prehistoric scene, including a giant dragonfly and dinosaurs of your choice.

Threats to Dragonflies and Damselflies

Worldwide dragonflies and damselflies are in trouble. You may be surprised to know that they are mainly tropical, so everything that you have heard about loss of tropical habitats applies to them. An example of tropical rainforest destruction in Indonesia is pictured right. This area was cleared to create a Palm Oil plantation.



Here in Europe, they like to live in unpolluted wetland habitats such as, streams, ponds, rivers and lakes. Unfortunately for them, wetlands are disappearing and a lot of water is now affected by chemicals from agriculture, and industry. Approximately 35% of the world's wetlands were lost between 1970-2015.

We have lost three breeding species in Britain in the last 50 years

An example of habitat loss in Britain comes from East Anglia: in 1630 there were 3,400 km² of wetland. This has reduced to only about 50km²! The story is the same across most of Europe too.

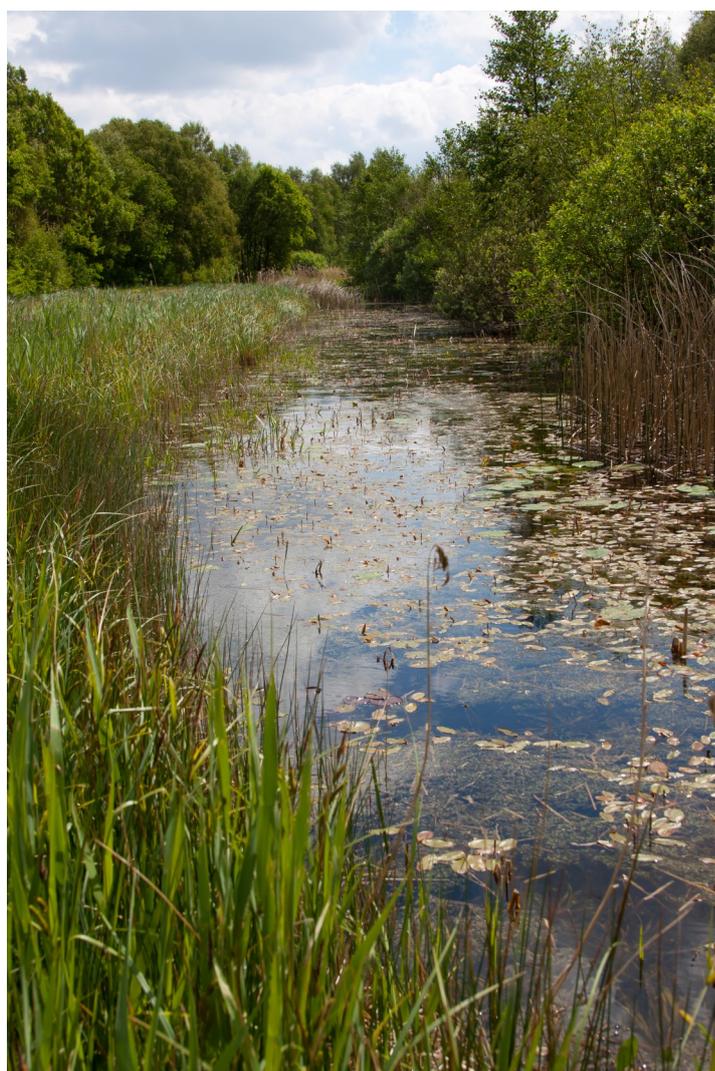
Dragonflies and damselflies spend most of their lives underwater as larvae. The larvae of all British species develop in freshwater, a habitat under threat :

- Farm ponds are being drained
- Ditches are being piped underground
- Rivers are being canalized
- Bogs are being dug up

Dragonflies and damselflies have been flying for over 300 million years.

Humans have been here for less than 1 million years.

It is time for us to give dragonflies and damselflies a helping hand.



Example of an ideal freshwater habitat

Worksheet 4

Read the questions on dragonflies and damselflies below and circle the correct answer or answers:

Q: Do dragonflies and damselflies sting?

Yes **No** **Sometimes**

Q: How long have they been around?

2 million years **Over 300 million years** **20 years**

Q: Can they warn us about pollution in the environment?

Yes **No**

Q: Were dragonflies around when there were dinosaurs?

Yes **No** **Don't be silly**

Q: Roughly how many species of dragonflies and damselflies are there in the world?

500 **1500** **5000**

Q: Roughly how many species are found in Great Britain?

5-15 **35-45** **350-450**

Q: Dragonflies and damselflies need our help because of the effects of:

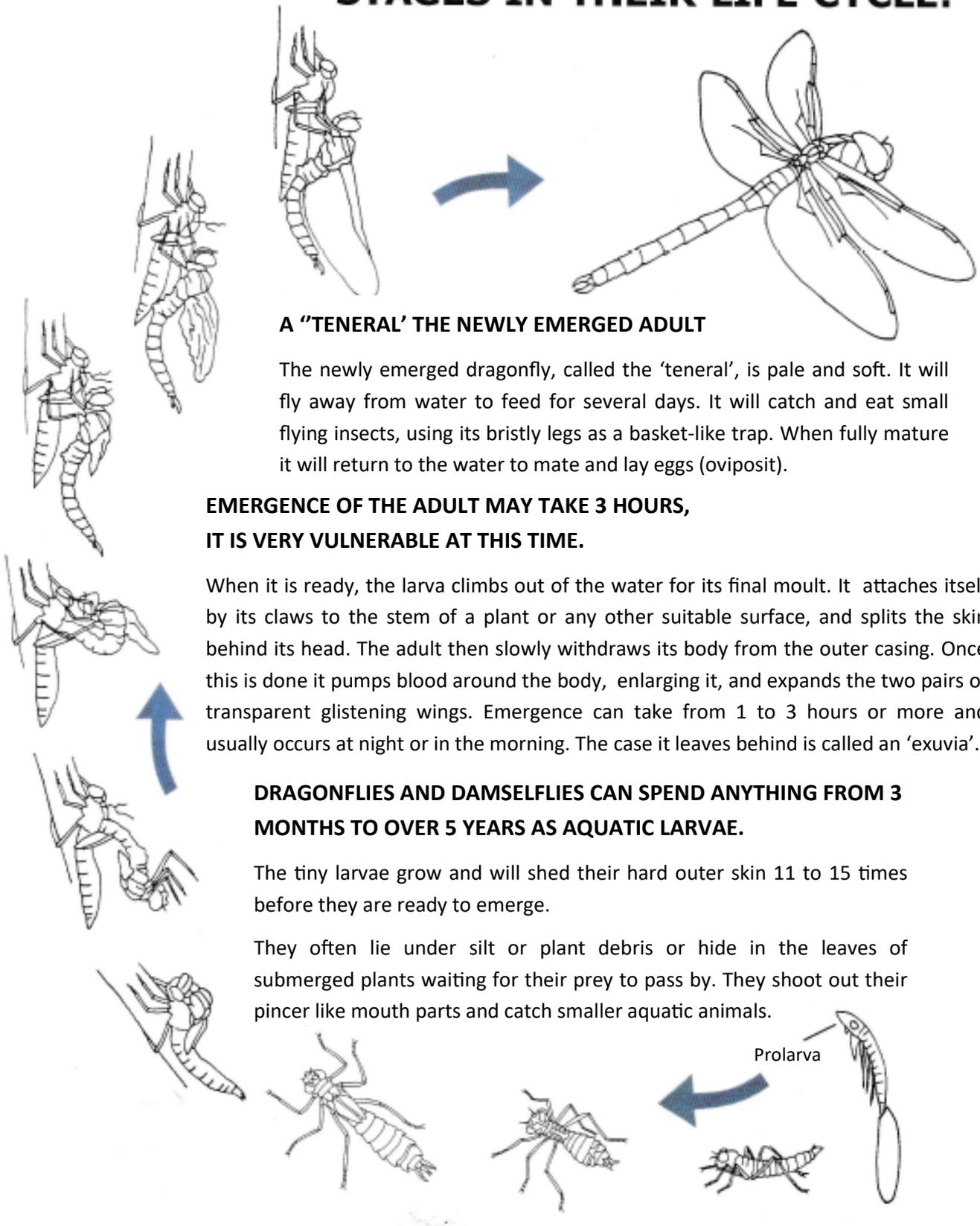
Drainage **Erosion** **Water pollution**

Q: In what habitats are dragonflies and damselflies found?

Ponds **Rivers** **Tropical rainforest**

LIFE

DRAGONFLIES AND STAGES IN THEIR LIFE CYCLE:



A "TENERAL" THE NEWLY EMERGED ADULT

The newly emerged dragonfly, called the 'teneral', is pale and soft. It will fly away from water to feed for several days. It will catch and eat small flying insects, using its bristly legs as a basket-like trap. When fully mature it will return to the water to mate and lay eggs (oviposit).

EMERGENCE OF THE ADULT MAY TAKE 3 HOURS, IT IS VERY VULNERABLE AT THIS TIME.

When it is ready, the larva climbs out of the water for its final moult. It attaches itself by its claws to the stem of a plant or any other suitable surface, and splits the skin behind its head. The adult then slowly withdraws its body from the outer casing. Once this is done it pumps blood around the body, enlarging it, and expands the two pairs of transparent glistening wings. Emergence can take from 1 to 3 hours or more and usually occurs at night or in the morning. The case it leaves behind is called an 'exuvia'.

DRAGONFLIES AND DAMSELFLIES CAN SPEND ANYTHING FROM 3 MONTHS TO OVER 5 YEARS AS AQUATIC LARVAE.

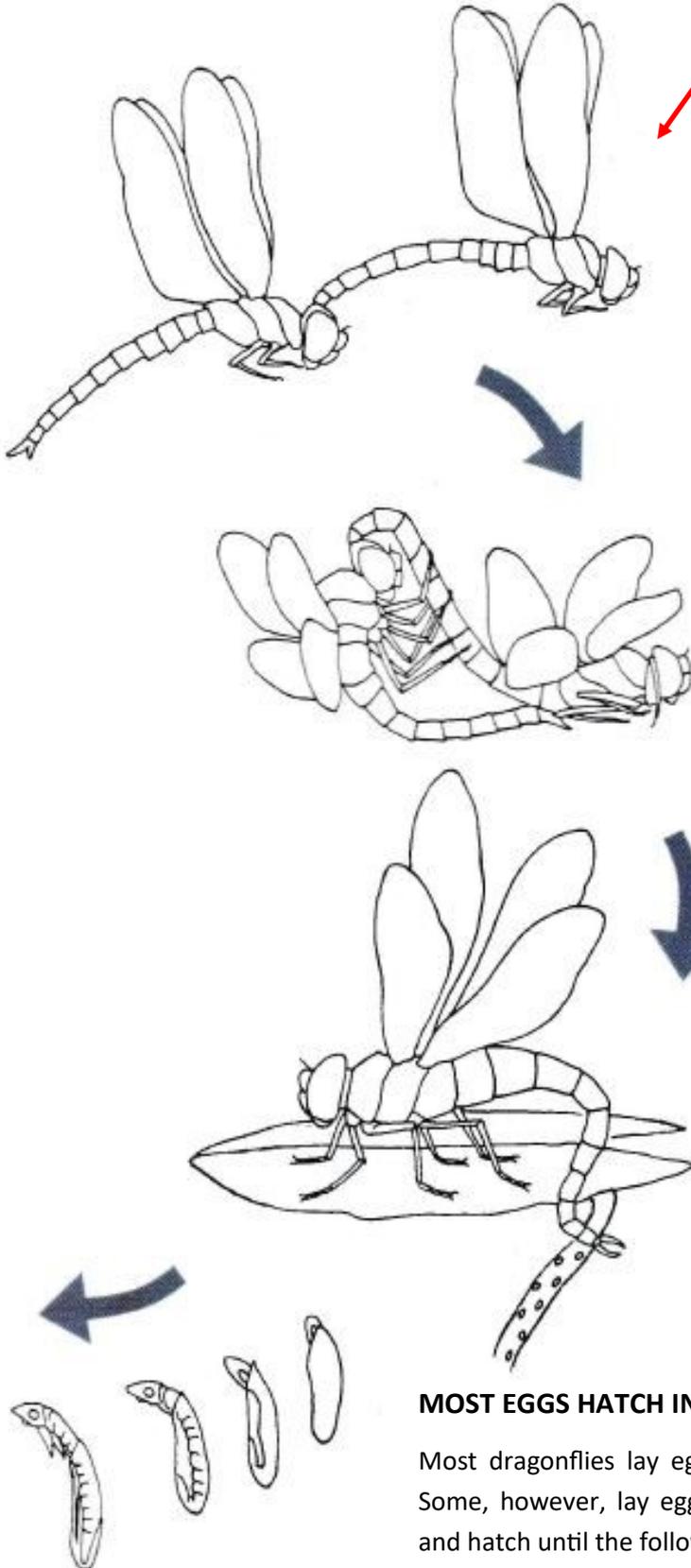
The tiny larvae grow and will shed their hard outer skin 11 to 15 times before they are ready to emerge.

They often lie under silt or plant debris or hide in the leaves of submerged plants waiting for their prey to pass by. They shoot out their pincer like mouth parts and catch smaller aquatic animals.

CYCLE

DAMSELFLIES HAVE THREE EGG, LARVA AND ADULT

A good place to start



MALE AND FEMALE DRAGONFLY FLY IN TANDEM

The male finds a female and uses his claspers at the end of his abdomen to hold her by her head (dragonflies) or neck (damselflies) to form a tandem pair.

WHEN THEY MATE THEY FORM THE SHAPE OF A HEART

They each curve their abdomen so that the end of the female's abdomen meets with the base of the male's in the so-called heart or wheel position. This can last from a few seconds to more than an hour depending on the species.

THE FEMALE LAYS HER EGGS (OVIPOSITION)

Some females lay eggs in plants in or near water; other species drop them directly into the water. Some will go right under the water to lay their eggs. The male often stays on guard to prevent any other male from mating with her.

MOST EGGS HATCH IN A FEW WEEKS

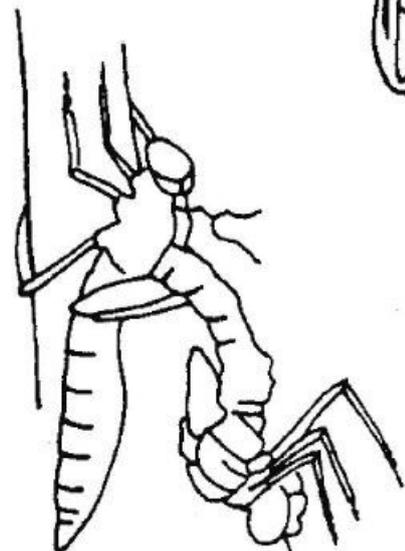
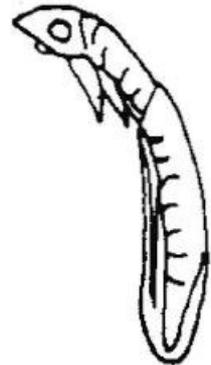
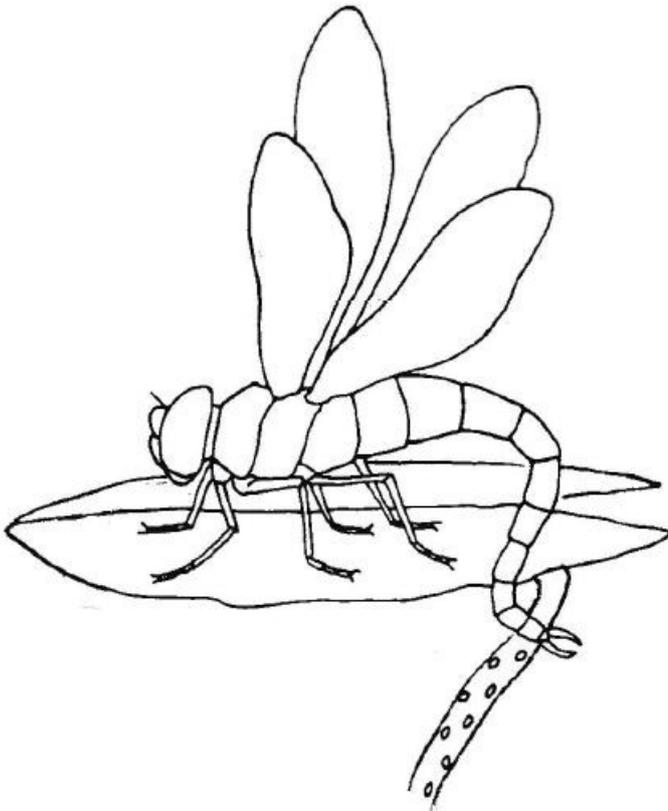
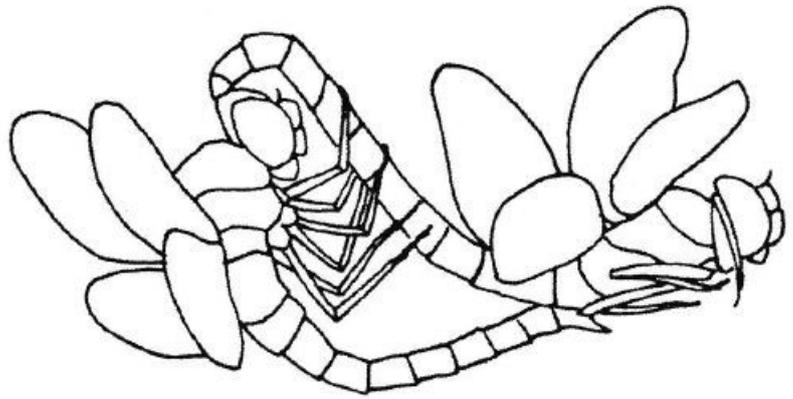
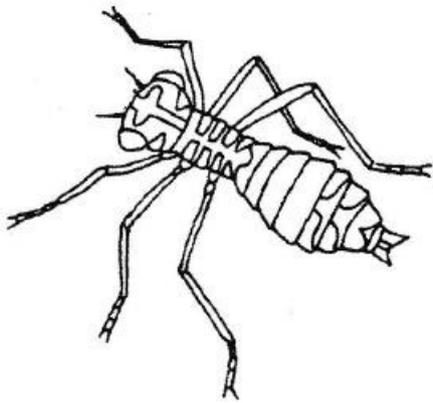
Most dragonflies lay eggs which will hatch within a few weeks. Some, however, lay eggs which will overwinter and not develop and hatch until the following spring.

Worksheet 5

Life Cycle

What to do:

1. Colour in the pictures below using photographs of real dragonflies, such as those in this booklet, as a guide.
2. Either—cut out each picture and stick it onto another piece of paper in the correct order of their full lifecycle. Or number the pictures on this page in the order that they should go in their full lifecycle.
3. Write a few words under each picture to explain what is happening.



Where and When Can You See Dragonflies and Damselflies

The best place to see adults flying is by fresh water; riverbanks, canals, lakes and ponds. This is because they come to water to mate and lay eggs.

If you are lucky and the weather is good, you may see large dragonflies, hawking up and down tirelessly. You may also see smaller ones perched over the water, or damselflies flitting close to the water plants.



You may also see dragonflies flying and feeding in sunny spots, protected from the wind, away from the water.

- They don't like windy, cold or wet days.
- When the weather is bad they will fly off to roost, sometimes high up in trees.
- They have also been seen using leaves as umbrellas.

Picture right: newly emerged Emperor dragonfly sheltering during bad weather (photo by Paul Ritchie)



In Britain the best time of year to see adult dragonflies is between May to September. Choose sunny, windless days between 11.00am—3.00pm for the best chance to see them. This is the time when males are looking out for females to mate with and are busy defending their territories from other males.

To see the larvae, look close to the banks of ponds, rivers and lakes where there is safe access. You will need a pond dipping net and a white plastic tray—this will help you to see what was collected in your net. There is no better way to get to know what insects live there and it is great fun!



Dragonfly and damselfly larvae can be found at any time of year, but the best time to look is between April and August as this is when many are at their largest and preparing to emerge. Always take care when pond dipping to not destroy the water plants or to trample the margins and **always put all of the insects back exactly where you found them.**



A dragonfly larva : Southern Hawker



A damselfly larva : Small red-eyed damselfly

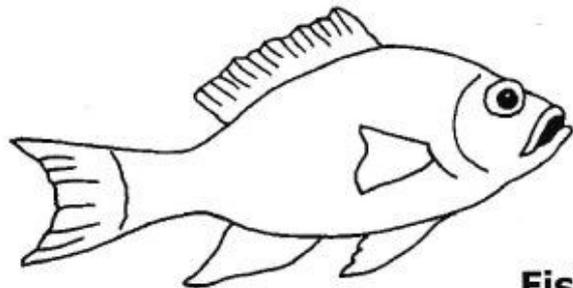
Food and Predators

Adult dragonflies and damselflies eat many flying insects, such as mosquitoes. They in turn have many predators: birds, frogs, spiders (damselflies often get caught in their webs), fish (when dragonflies and damselflies are laying their eggs), ants (when newly emerged and unable to fly away) and carnivorous plants (damselflies get stuck in sundews).

The larvae are eaten mainly by fish, but also by water beetles, water scorpions and some birds. Larger larvae will also eat smaller larvae, so always try to keep them separate when pond dipping.



Water Beetle



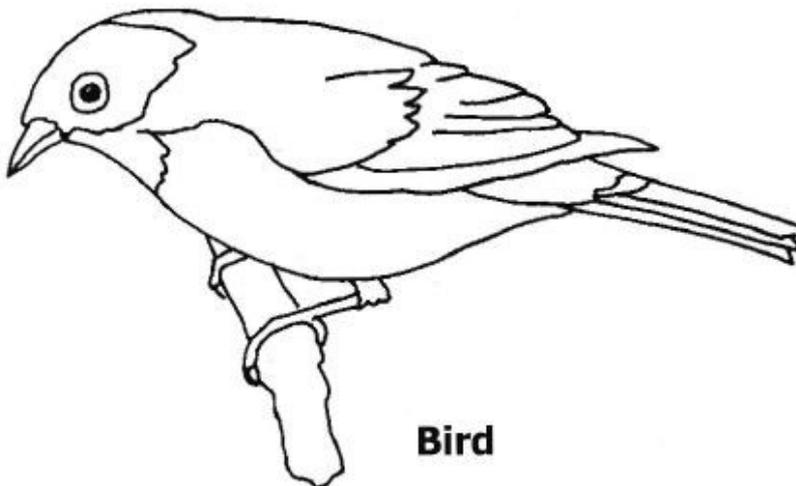
Fish



Frog



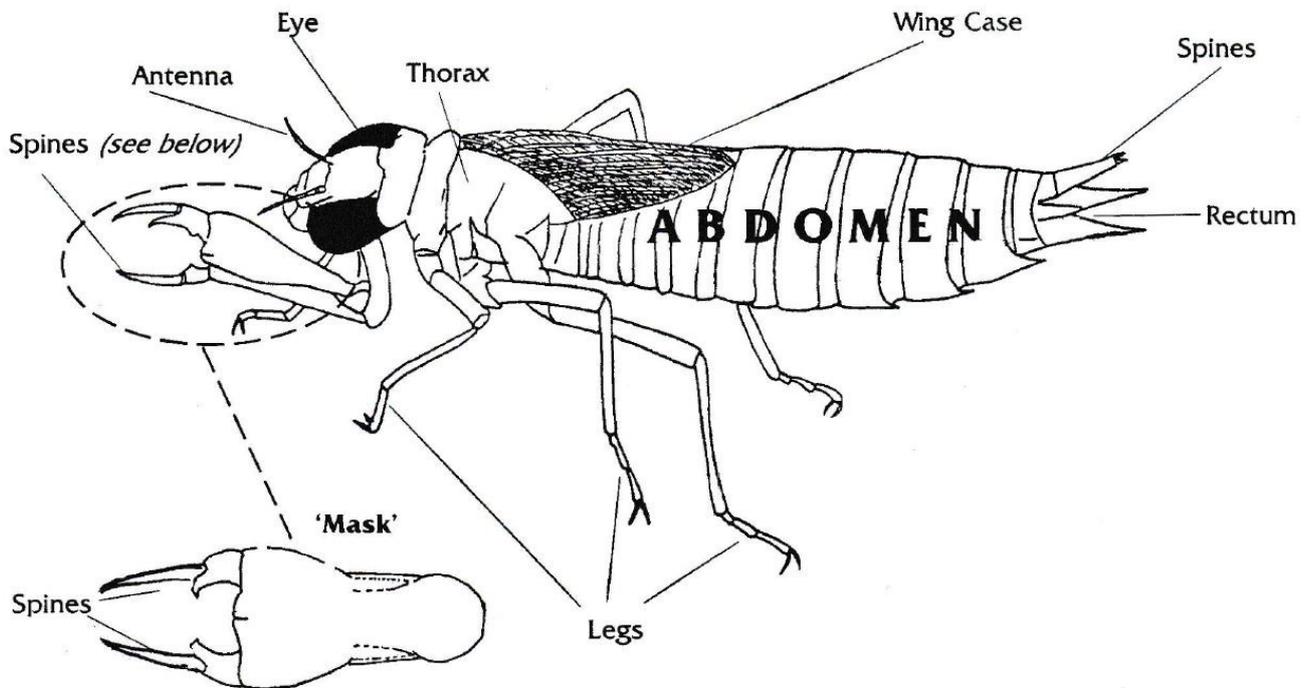
Mosquito



Bird

What do larvae eat?

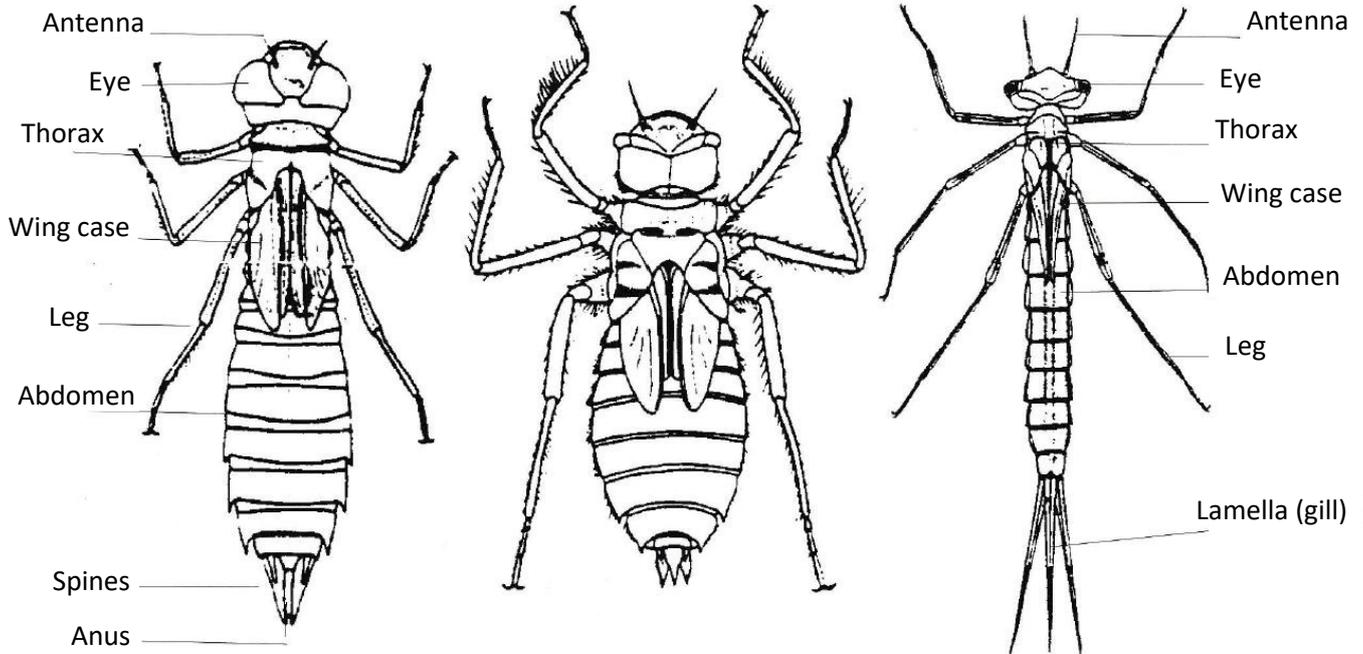
They eat water fleas, bloodworms, other insect larvae, snails, tadpoles and small fish—the larger larvae taking the largest prey. The prey is caught with a modified lower lip. It is unique to dragonflies and damselflies. It is commonly known as the mask.



This mask, or lower lip, is hinged and folded under the head. At the tip are spines that stab the prey when the mask is extended.



Dragonfly larva capturing a freshwater shrimp, using the spines on the end of its mask.



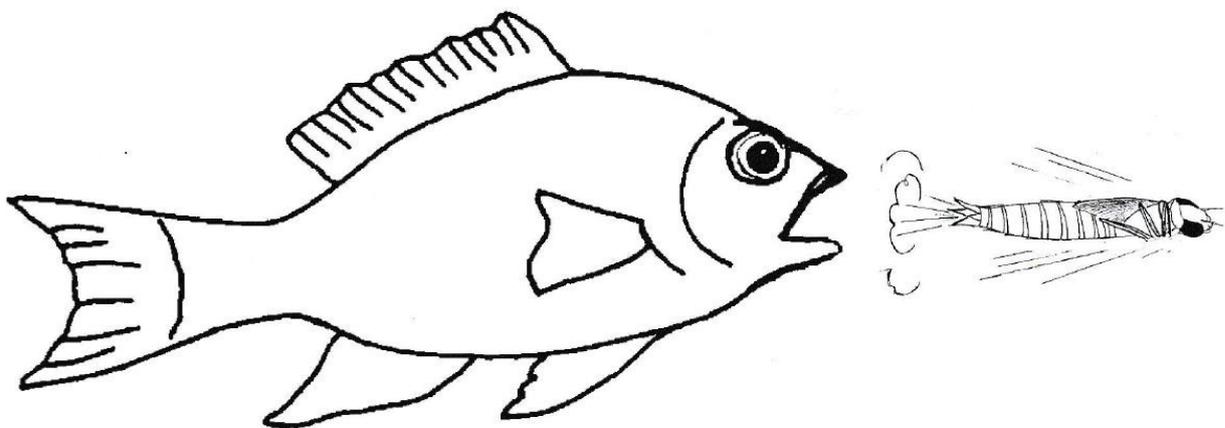
Weed dwelling dragonfly larvae are robust and torpedo shaped

Bottom dwelling dragonfly larvae are flattened and often covered in silt or debris

Damselfly larvae are slender and cylindrical with three flat appendages at the back which function as gills and are called lamellae

The body of the dragonfly larva ends in five little spines. It has gills but you cannot see them because they are in a special region of its gut (the rectal chamber). It 'breathes' water in and out through its anus. The water passes over the gills. The gills remove oxygen from the water.

When trying to escape, dragonfly larva can jet propel themselves through the water by suddenly expelling water in the rectal chamber through their anus.



Damselfly larva can also take up oxygen through their gills . They move about and escape from predators by moving their abdomen and gills from side to side.

Group Project Ideas

- Design a beautiful habitat for dragonflies and damselflies to live in, draw it on a big sheet of paper and write down why it is suitable for them to live in.
- Do a large drawing or collage of pond life for display — use your own notes from your pond dipping trips as inspiration.
- Draw a really horrible habitat, dirty, polluted, full of litter and then create a dragonfly that could live there—what adaptations would it need to survive here?
- Come up with alternative names for the body parts of dragonflies and damselflies, describing what the parts do—be creative and feel free to make the names fun so that others will remember what they do.



Take **photos** of your work and **send them to us** so that we can share with other dragonfly fans!

Email them to: consoff@british-dragonflies.org.uk

Or get your teacher /parent/ guardian to post them on social media tagging us in:



@BDSdragonflies



British Dragonfly Society



British Dragonfly Society

Worksheet 6:

Meanings of words:

Write the answers to the questions in the boxes below, all the answers can be found in this booklet.

What is a **lamella**? And what does it allow the larva to do?

What is a **teneral**?

What is an **exuvia**? (have you collected one from a nearby pond yet?)

What does flying **in tandem** mean?

What is a **mask**? What is it **used for**?

What is **oviposition**?

Worksheet 7:

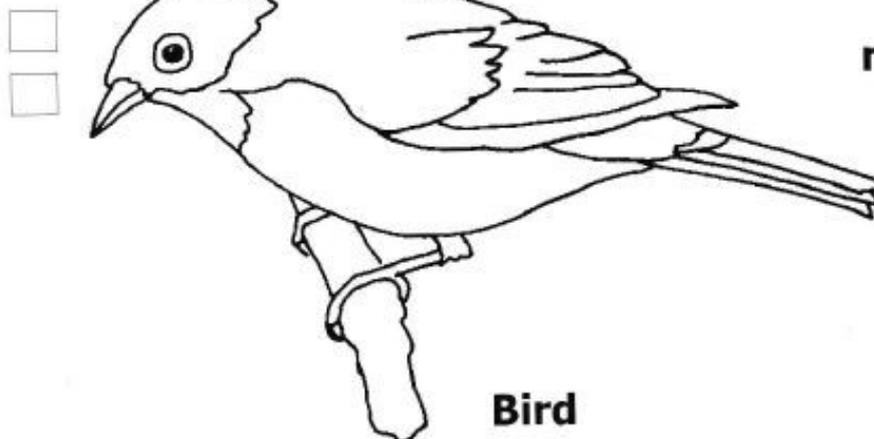
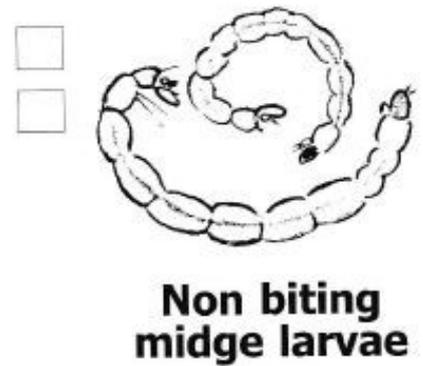
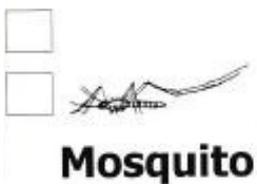
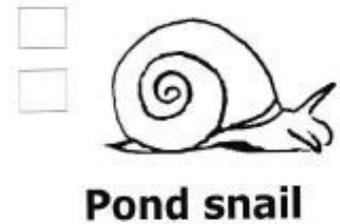
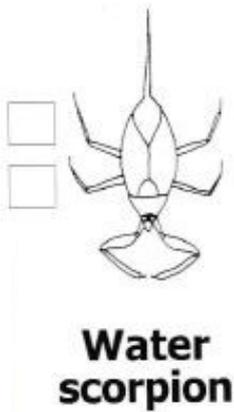
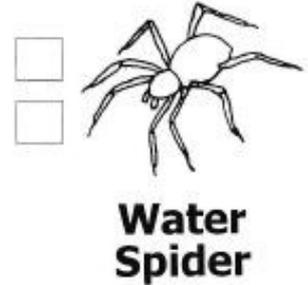
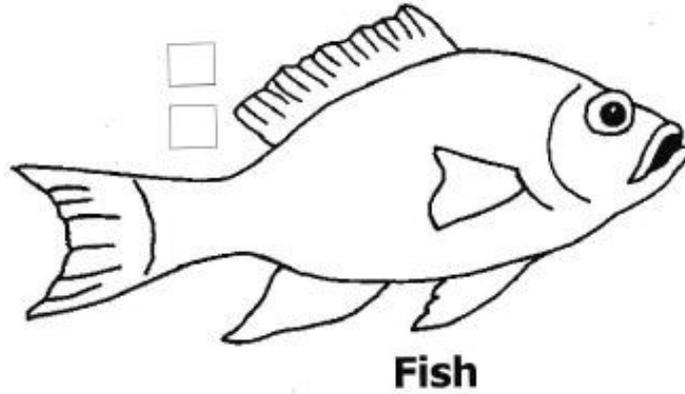
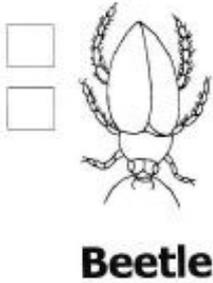
What to do:

Explain how dragonfly larvae breathe. Feel free to draw a diagram if this helps you to explain it:

Explain how damselfly larvae breathe. Feel free to draw a diagram if this helps you to explain it:

Worksheet 8: Predators and prey of larvae and adults

What to do: Colour in the boxes next to each creature with **red** for 'predators' and **green** for 'prey' - you may need both colours for some. Then colour in the creatures themselves.



Dragonfly and Damselfly Eyes



Dragonfly and damselflies both have two extremely large compound eyes, each with up to 30,000 lenses/photoreceptor units, known as ommatidia. They have virtually 360 degree vision, both vertically and horizontally. 80% of their brain is involved with vision. They also have three small light sensors (ocelli) used partly for flight stability. In comparison, we only have one lens in each eye.

Different parts of the eyes have different functions. Some parts are super-sensitive to movement, some to colour, some to flight patterns.

What do they need such wonderful eyes for?

- ✓ Hunting and catching food
- ✓ Spotting and avoiding predators
- ✓ Finding and defending territory
- ✓ Choosing mates and selecting places to lay eggs

If you want to see a dragonfly or damselfly closely, move **very slowly** towards it. **Remember that it can see better than you. Any sudden movement and it will fly off!**

Dragonfly and Damselfly Flight

Dragonflies and damselflies have been flying successfully for over 300 million years. Some other insects can fly as well in certain ways—for example the horsefly has agility, the hawkmoth has speed—but for overall performance there is nothing to touch them.

- ✓ Dragonflies can fly up to 36km per hour (23 miles per hour) and damselflies about 10km per hour (6 miles per hour)
- ✓ Dragonflies can cover 15 metres in less than 1 second—from a standing start
- ✓ They can hover like a helicopter, fly backwards, and turn around in their own airspace
- ✓ Dragonflies can fly very long distances—for example from Holland to England

Why do they fly so well?

They need to hunt for food, catching their prey on the wing. They need to look for new habitats to colonize and to find mates. They need to avoid being caught by birds.

Wing Design:

The structure of their wings is an aerodynamic designers dream. Each wing can twist and operate separately. It carries strength in its complex system of veins. The wing membranes vary in thickness, like modern racing sails. The coloured mark at the end of each wing, called the Pterostigma, has a heavier density and acts as a counterweight in flight.

Making whirlwinds:

They combine their wing structure and muscle power to make mini-whirlwinds. When they twist their wings on the down stroke they create a mini-whirlwind over the top surface of their wings. This moves air very fast over the top surface and so lowers the air pressure there. They can also twist their wings on the upstroke. This combination gives them phenomenal lift and superb flight control.

Muscle power:

Some of the muscles which control the movement of the wings are located at the base of each wing. These muscles contain resilin, a protein molecule which can expand and contract very fast. Resilin exists in the knees of fleas—giving them their jumping power—and in the hooves of horses.

A Key to Future Aircraft?

Engineers classify the mini-whirlwinds as ‘unsteady airflows’. Some engineers think unsteady aerodynamics may be the key to future aircraft development. Navigational and flight control devices based on research into several types of insects, including dragonflies, have been developed. These include an electronic model of the ocelli (simple eyes on the head) which maintains level flight. Drones have been inspired by dragonfly flight already and it is thought that this bio-inspired approach to design can also make wind turbines more efficient and flexible. Dragonflies have also inspired space exploration, NASA have built planetary exploration drones and named missions after dragonflies.

Worksheet 9: Dragonfly and Damselfly Eyes and Flight

What to do:

1. Do a drawing of what you think you would look like if you had eyes like a dragonfly.



2. Answer the following questions:

How fast can a dragonfly fly?

Can they fly backwards?

How long would it take a dragonfly to travel 72 km?

How Can You Help?

Pond Digging

Large amounts of good dragonfly and damselfly habitats have disappeared. So if you can dig a pond, or adapt an existing pond, for them, you will be tipping the balance back a little.

Building a new pond is very exciting but it needs a lot of careful planning and you will need help from an adult. Spare a thought, for example, for the habitat you will change with your pond. **Is it important for some other reason?**

If you know of an old pond which could be opened and cleared, why not find out what could be done? A nice mixture of local water plants will attract dragonflies and damselflies to your pond. You will need three types:

- ✓ Oxygenators, to keep the water oxygenated and to provide shelter for the larvae
- ✓ Surface coverers to provide areas of shade and oviposition sites
- ✓ Tall-stemmed plants for the emergence of adults



There is some excellent advice on our website about creating a pond for dragonflies and managing habitats throughout the year:

www.british-dragonflies.org.uk

You can also buy some excellent books such as the 'Dragonfly Friendly Gardener' by Ruary Mackenzie Dodds.

Worksheet 10: Wordsearch

What to do:

Find the following words in the Wordsearch below.

- | | |
|--------------|-------------|
| 1. DRAGONFLY | 8. ANTENNA |
| 2. LARVA | 9. EXUVIAE |
| 3. WINGS | 10. TENERAL |
| 4. TANDEM | 11. LAMELLA |
| 5. FOSSIL | 12. ABDOMEN |
| 6. AQUATIC | 13. EGGS |
| 7. DAMSEFLY | 14. CLASPER |

D	R	A	G	O	N	F	L	Y	K	F	O
R	W	A	L	L	E	M	A	L	C	S	E
A	A	I	G	E	M	E	D	N	A	T	L
B	D	K	N	G	O	I	E	E	V	E	Y
D	H	A	C	G	N	P	W	D	R	N	L
O	I	L	I	S	S	O	F	Q	A	E	F
M	E	L	T	V	U	P	O	U	L	R	L
E	L	E	A	T	U	Y	H	P	L	A	E
N	L	T	U	E	E	X	G	F	N	L	S
R	A	U	Q	W	N	A	E	N	B	C	M
E	F	B	A	N	T	E	N	N	A	X	A
R	E	P	S	A	L	C	C	G	O	N	D

We hope that you have enjoyed learning about the fascinating world of dragonflies and damselflies. If you would like to carry on learning please take a look on our website for more free resources and lots of information.

www.british-dragonflies.org.uk



All that is left to do now is to get out and see some real life dragonflies and damselflies. Enjoy!

