Fig. 1: The Brown lipped snail (*Cepaea nemoralis*) has a surprisingly aesthetic appearance and diversity in its stripes.

The Snail

The snail he lives in his hard round house,
In the orchard, under the tree:
Says he, „I have but a single room;
But it's large enough for me."

Anonymous

Fundamental aims of the activities

- To discover diversity among native snails
- To reduce prejudices and feelings of disgust
- To recognise the role and usefulness of snails in an ecosystem
- To awaken interest in snails as examples of molluscs

Snails

Snails are very suitable for use in class because of their slow way of moving and because they are very easy to keep. They are easy to find and to observe. Most city children know something about snails, too. The starting point is therefore the immediate environment and the direct experiences of the pupils.

The aesthetic appearance and diversity of snails stands in opposition to their very low popularity. When they think of snails, many people associate them with the endless fight against the seemingly invincible slugs in their gardens. Our relationship with this interesting and extremely diverse group of animals is often reduced to that of enemies. The cause of this is mainly the Portuguese slug, which reproduces in large numbers, and a few other slug species.

An important theme of the "snail activities" is therefore awareness when dealing with other living creatures. The thoughtless treatment of snails in particular by young people should encourage us to show

our pupils the interesting and beautiful aspects of these animals. This group of animals is often completely misunderstood and now endangered, and at the same time it is an example of how we are dealing with our living environment. The sole benchmark “useful” versus “useless”, from the perspective of humans, separates species into the questionable categories “worthless” and “valuable” (because they are cute or useful).

Snails can cause feelings of disgust in children and young people. But if they observe them more closely and have contact with them, then curiosity and thirst for knowledge usually predominate. The pupils can discover astounding phenomena which they are able to examine themselves in simple experiments.

1. Factual information about snails

Biology of land snails

Snails (*Gastropoda*) make up the class of animals with the most species from the phylum molluscs (*Mollusca*). They can live on land as well as in the water (snails and shellfish). In the following, only the biology of the land snail is described.

In land snails, oxygen intake occurs through a network of thin-walled blood vessels in the mantle cavity under the shell. Loss of water through breathing is a serious problem for snails that live on land. Protection against loss of water is provided by a particularly thick fold of skin in the mantle which closes off the mantle cavity. The stream of air which the snail breathes in passes through a small opening called the breathing pore or pneumostome. The snail can use its muscles to control the opening of the breathing pore. Breathing takes place by opening and closing the breathing pore as well as by raising and lowering the floor of the mantle cavity, which you can compare to the use of the diaphragm in vertebrates.

Many snails make use of the cool and damp conditions at night and are nocturnal. If it is too dry, they look for a suitable hiding place to wait out the dry period. Some snails crawl up plant stems and fall into a state of dormancy. They then close off the entrance to the shell with a seal made of slime, with which they also stick themselves to the surface they have chosen.

Because of their famously slow method of movement, the snail’s radius of activity is very small. The chance of meeting a partner for mating is rather low. Therefore androgyny is an advantage: they have double the chances of reproduction with a low number of individuals because the snail can reproduce with every member of the same species it meets, assuming they are ready to mate. In contrast to the sea snail, the development of the land snail takes place in a closed egg, from which a complete young snail hatches.

A land snail’s field of vision is greatly improved by having eyes on a long pair of tentacles. The second pair of smaller tentacles serve above all as feelers.

Snails

Snails usually have a spiral-shaped shell which is wound around a spindle. This is the snail shell which they retract their soft bodies into when there is danger. Because of this, they are asymmetrical, and this asymmetry is mirrored inside their bodies. The snail shell is always constructed in the same way. The direction of the spiral is typical for a particular species.

You can occasionally find snails with the spiral formed in the other direction, but these are very rare. These rare animals are called “snail kings”. By eating food rich in lime, the snail builds its shell which provides protection against predators. The shell provides extra protection against drying out and can be closed off with a slime or lime layer during dry periods.

Slugs

We usually call all snail-like animals without shells that live on land slugs. After periods of rain we can often find the Portuguese slug, and many of its smaller relatives also live in our gardens. The gradual reduction of the shell can be observed in some families of snails. The family of glass snails (*Vitrinidae*) has a very thin shell, the walls of which look translucent. In the common slugs (*Arionidae*), all that is left of the shell of its ancestors is a few grains of lime.

Not having a shell saves energy as the slug does not have to carry it around. Instead of a protective shell, slugs have very thick slime which protects them against drying out and had a disgusting taste which helps to protect against predators. The regional poet Hermann Loens described this vividly in his story “A disgusting animal” and he also did his own experiments on the subject.

Fig. 2: The Great grey slug (*Limax maximus*) is a harmless waste recycler in the garden.

Snail slime and snail’s pace

Most native snails use their muscular foot to move themselves along on a trail of slime. From below you can observe the wavelike contractions of the foot muscle.

The snails’ crawling movement is one of the methods of moving which uses the most energy in the animal kingdom. Snails produce their own “road surface”, a gel which changes its physical characteristics according to the situation: sometimes it is a glue, sometimes a lubricant.

Because of the amount of energy necessary to move, some snails spend their whole lives in a radius of only a few metres from the place where they hatched. On the other hand, snails can reach a speed of up to 20 metres per hour, in particular when they are moving along another snail’s slime trail when they are looking for a mate.

Fig. 3: Contracting waves as seen when a snail crawls over a piece of glass. The dark, moving stripes are visible. On the left of the picture you can see the characteristic slime trail that the snail leaves behind it.

The radula

Like all molluscs, snails have a rasping tongue, the radula, as a mandible. This is full of horny teeth made of chitin and is used for scraping off particles of food from underneath. If you let a snail crawl over your hand, you can feel the rasping.

Senses

Perception of light

A Roman (or Burgundy) snail can see with the eyes on the ends of its two longer feelers. In the thickening at the end of the feelers you will find the snail's eyes, but without a magnifying glass you can only see them as two black dots. This snail at least has eyes with lenses which are made of a formless, light refracting gelatinous mass in the ball-shaped optic vesicle. The outer wall of the feelers consists of transparent cells and forms a protective corneal skin. There are also other cells around the snail's body which can sense light. That is why a snail retreats into its shell when a shadow suddenly falls over it (in the wild this is a possible predator).

Fig. 4: The White lipped snail has two pairs of feelers on its head: the upper feelers have an eye and an organ for the sense of smell, and the lower feelers have an organ for the sense of touch. At the slightest disturbance they are retracted extremely quickly.

Sense of touch

The whole body of the snail is sensitive to touch. This is especially true of the feelers or tentacles of the snail and the rest of the head. When the snail comes in contact with an obstacle, a retractor muscle retracts the part of the body that has been touched with lightning speed. In the case of vigorous stimulation, the whole snail can retreat into its shell by using a strong muscle attached to the centre of the shell.

Sense of smell and taste

Snails can sense sources of food at considerable distances (up to several metres) and move purposefully towards them. A snail will crawl towards a lettuce leaf because it can smell the leaf from a distance. But when the lettuce has been treated with a foul-tasting chemical, for example acetic acid, as an experiment, the snail turns away after the first contact and literally starts to foam – a method of protection against contact with unpleasant substances.

Perception of temperature and moisture

The perception of temperature and humidity is essential to survival for snails. They make use of cooler temperatures in the relatively damp evening air, and during the day when the air is hot and dry they look for a hiding place to rest in. In general, our most common snails prefer cooler, shady areas rather than places where the sun is shining. This can be observed in any garden where snails purposefully move towards areas which have just been watered.

Sense of hearing

This is the only sense which snails do not have.

Way of life

Snails are, with only a few exceptions, plant eaters. In contrast to the opinion of most people, a large number of snails do not feed on fresh green plants but prefer decomposing plant material. Some snails even love eating moulds. Snails eat an impressive amount of plant material in relation to their body mass: a fully grown Roman (Burgundy) snail eats up to 6 grams of plant material per day.

In autumn the Roman snails bury themselves in an area protected from the wind and covered with vegetation. They dig a hole with their foot and spend the winter there. This winter hole is closed off from the inside with earth. After that, the snail produces a secretion containing lime which becomes a hard covering when it comes in contact with the air. This is called the epiphragm and solidifies to close off the opening to the shell. Now the snail can survive frosty winter temperatures.

Importance in the ecosystem

Snails play an important role in shredding and transforming organic substances. They combine their slime with particles from the ground and improve the structure of the soil. Many snail species are specialised in feeding on unusual materials or those difficult to digest and so they contribute to the decomposition and transformation of these substances.

Because of their high biomass, snails are on the other hand an important source of food for other animals. They are a source of food for birds, hedgehogs, moles, amphibians, reptiles, ground beetles and countless spider species. In central Europe, the very common banded wood snail is an important source of food for thrush species, which crack the snail shell using stones on hard ground. Some snail species are predatory themselves. Roman (Burgundy) snails eat the eggs of other snail species.

From the human's point of view, only a few snail species are harmful to crops and garden plants. The most unpopular and most common one is the introduced Portuguese slug (*Arion lusitanicus*) because of its high rate of reproduction. The garden slug (*Arion hortensis*) is also unpopular, as are several other slug species of the genus *Deroceras*.

Fig. 5: The Red slug (*Arion rufus*) used to be common but has decreased dramatically and is now endangered over the whole country.

Endangered species

Public interest is concentrated on the snails which are considered to be harmful. It is easy to overlook the fact that non-selective use of snail bait affects all species of snails. Therefore many harmless species such as the waste recyclers and the attractive tiger slug are also affected, as are countless species which prey on snails, for example, thrushes, hedgehogs, ground beetles etc., because their source of food is reduced in our gardens. As well as that, snails, together with aphids, make up the greatest animal biomass in our gardens. Killing off snails removes a significant basic food resource in a food web and has direct consequences for many predators. Many people are not aware of this aspect when they lay out snail bait.

60 % of all snail species in Bavaria are already endangered – that means more than half the native molluscs. This figure is considerably higher than in birds (47 %) and mammals (49 %) and shows the dramatic situation among Bavaria's snail fauna. It is particularly worrying that species which used to be common, such as the red slug (*Arion rufus*) and many other "non-target species" of snail removal, are now on the Red List of endangered species in Bavaria (Bavarian

Fig. 6: The Marsh whorl snail (*Vertigo antivertigo*) is an endangered species in Bavaria.

State Office for Environmental Protection 2003). So there is a danger that, in the long term, a significant proportion of Bavaria's snail fauna will die out.

Literature

Identification books

Pfleger, V. (1984):
Snails and seashells of Europe. Land and freshwater species. (Schnecken und Muscheln Europas. Land- und Süßwasserarten). Kosmos Verlag, Stuttgart
This guide to the more common snails and seashells is easy to understand and has good illustrations. However, it is now only to be found in second-hand bookshops.

Gloer, P. u. C. Meier-Brook (2003):
Freshwater molluscs. An identification guide for the Federal Republic of Germany. (Süßwassermollusken. Ein Bestimmungsschluessel fuer die Bundesrepublik Deutschland). Deutscher Jugendbund fuer Naturbeobachtung, 13th edition, Hamburg

Hausser, J. (2005):
Identification Guide for Gastropods in Switzerland. (Bestimmungsschlüssel der Gastropoden der Schweiz). Fauna Helvetica 10, Neuchatel.
These are good identification guides for native snail fauna.

Teaching materials

Buholzer, T. (2002):
The Life of Snails. (Schneckenleben). Patmos Verlag, Düsseldorf
This has good photos and the text is easy to understand. For years 1-6.

Naber, A., Latorre, S. (2001):
The Creative Book "Snails". (Das kreative Sachbuch „Schnecke"). Als Verlag, Dietzenbach
Suitable for years 1-4. Covers every aspect of the topic of snails.

Wieringer, S., Zindler, K. (2006):
The Snail Workshop. (Die Schnecken-Werkstatt). Verlag an der Ruhr, Muehlheim a.d. Ruhr
Suitable for years 1-6. Loose leaf copies. Ideas for an interdisciplinary approach (English, German, Maths). Suitable for organising a project day at school.

Snails. (Schnecken)
FWU-Nr. 4602440, DVD, 31 mins, 2007.

From the „Löwenzahn" series: Peter's Snail Race.
(Löwenzahn: Peters Schnecken rennen)
FWU-Nr. 4231594, VHS, 25 mins, 2003/1999.

The Roman/Burgundy Snail. (Die Weinbergschnecke)
FWU-Nr. 4201671, VHS, 11 mins, 1993/1987.

Nature in the Garden – The "Naked" Truth.
(Natur im Garten – Die „nackte" Wahrheit)
DVD, 63 min, 2002. Universum Film. Co-production by ORF, epo-film and the LW-Werbe- und Verlagsgesellschaft.
An unbelievably humorous film about the everyday conflict between garden owners and snails in the garden. With Erwin Steinhauer and Alfred Dorfer.

Internet addresses

www.eduvinet.de/mallig/bio/7shnek/7snekM1.htm
Position and function of the inner organs, from junior high level.

www.rz.uni-frankfurt.de/~hlehnert/schnecke/allgem.htm
Nice identification guide, from year 2.

www.weichtiere.at
Comprehensive information, nice photos. For junior and senior high school as well as for teachers to use for research

www.affenterz.de/loewenzahn/thema/ausgabe26/page1.asp

Informative website from the series "Löwenzahn". Can be used from primary school upwards.

www.kidsnet.at/Sachunterricht/schnecke.swf

Quiz for children from year 2.

2. Legal information and handling of snails

For the purposes of education, all large snails are allowed to be used for the activities described if they are kept in a humane method. The only exception is the Roman (Burgundy) snail (*Helix pomatia*) which is specially protected according to the Federal Species Conservation Act. It falls under the bans concerning species protection according to Article 44, Paragraph 1 of the Federal Nature Conservation Law (BNatSchG). According to this law, it is forbidden, among other things, to take Roman (Burgundy) snails away from the wild. However, in Article 3 of the Species Protection Legal Exemptions, the following is allowed for purposes of education: "Teachers at state or private educational institutions according to Article 3 of the Bavarian Law for Childcare and Education, teaching staff of pre-school and childcare institutions, according to Article 2 of the Bavarian Law for Children's Care and Education, as well as staff of other environmental education institutions are allowed to use specially protected animal and plant species in their lessons in areas such as ponds and gardens which have been created for education and training purposes. This is according to Article 10, Paragraph 2 No. 10 BNatSchG". They are only allowed to take as many animals as are absolutely necessary, and after the activity the animals are to be let go again at the same place from which they were taken.

In all other cases, you must apply for an exemption from the bans in Article 42 Paragraph 1 of the Conservation Law (BNatSchG) from the Upper Conservation Authority at the corresponding government offices. You can find a sample application in Appendix B at the end of the whole publication. The governments and their addresses are listed in Appendix C at the end of the whole publication. You must carry this exemption with you when you are taking the animals.

The hints for keeping the animals appropriately and their careful handling must also be kept to when looking after snails. You must discuss this with your pupils before the activity. Before every activity, point out the rules in the box on the right.

Never pull a snail off a smooth surface (you could damage its retractor muscle). **Pick up it by its shell and carefully pull it sideways from the ground.**

Hint: If a snail has retreated into its shell, the teacher can encourage it to come out by placing it in warm water (c.30deg C). The snail will not drown. Depending on the species it can survive for over 12 hours under water. Please do not experiment with this!

For reasons of hygiene, you should **wash your hands** after every activity.

Larger snails like, for example, banded snails and Roman (Burgundy) snails have the advantage that you can pick them up by their shells and do not get slimy fingers.

3. Activities

Fundamental aims of the activities

- To discover diversity among native snails
- To reduce prejudices and feelings of disgust
- To recognise the role and usefulness of snails in an ecosystem
- To awaken interest in snails as examples of molluscs

Activities

A 1 **Discover diversity among snails**
Knowledge of species

A 2 **Building a snail terrarium**
Keeping snails temporarily, habitat, accepting responsibility for an animal

A 3 **Measuring, weighing and drawing snails**
Examine the body structure of a mollusc

A 4 **A snail's movement**
Sequence of movements, speed

A 5 **Snail slime**
Recognise the function of snail slime

A 6 **A snail's senses**
Reaction to light, touch, chemical stimulation

A 7 **Observe a snail's food intake**

A 8 **Diversity among snail shells**
Variation within a species as a key principle of evolution

Additional material

A 1_1 Identification handout **Snails I**

A 1_2 Identification handout **Snails II**

A 1_3 Identification handout **Slugs**

A 1_4 Identification handout **Water snails**

A 1_5 Identification handout **Molluscs**

A 3_1 **Outer features of snails and slugs**

Discover diversity among snails

Factual background to the activity

Most pupils whose parents have their own garden will know about the problem of the "plague of snails" in the vegetable garden. Of the 500 snail species in Bavaria, only a few of them cause damage by eating crop and garden plants. Most snails are (from the point of view of the gardener) harmless or they are even compost recyclers and are an advantage because they improve the soil. The problems are caused by species that reproduce heavily, especially the Portuguese slug (*Arion lustianicus*).

With the negative image of snails as a background, the snail collecting activity receives special meaning. When collecting, the astounding diversity among snails will become clear. When you discuss the results of the collection together afterwards, it is a good opportunity to mention the importance of snails in the ecosystem and also to talk about the topic of the fight against snails. You can find reasons for and against fighting snails and discuss them with your pupils.

Reasons for the fight against snails:

- the Portuguese slug has too few predators to prevent large scale reproduction
- plants which are in danger from snails can barely survive without our help
- the iron compounds you can get today to fight snails are relatively compatible with nature and are biodegradable
- the plants that are in danger are effectively protected for a particular amount of time

Reasons against the fight against snails:

- snail poisons like "snail bait" only fight the symptoms; the actual causes of the snail plague (for example, not enough predators, growing of plants that snails love, too much fertiliser) are not solved
- the use of snail bait must be repeated continually and is expensive in the long run
- sometimes passive measures are enough, like building a fence against the snails or collecting them up to protect plants that are in danger and to avoid the use of poisons
- you can choose plants for your garden which snails do not like (for example St. John's wort, yellow chamomile or marigolds)

Season:

Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug

Grade level:

PS JHS SHS

Development:

Aims of the activity

- To be able to identify native snail species with the help of illustrations

Materials

- Container for collection
- Gloves for particularly sensitive children; you can also use a large leaf to touch slugs if necessary
- Additional Materials A1_1 to A1_3 Identification handouts **Snails and slugs**
- Also the Additional Materials A1_4 to A1_5 Identification handouts **Water snails and Molluscs** if there is a pond or other body of water. Several kitchen sieves or large-meshed nets are useful for searching round the edges of the water
- Magnifying glass (10x) for looking at very small snails
- Observation report

- using poisons against snails does not differentiate between the problematic snail species and the species which are not a problem and which make up the majority of the snails; it also affects the Roman (Burgundy) snail and the Great grey slug which are harmless recyclers
- snails are an important food source for many other animals (for example, blackbirds, thrushes, hedgehogs, ground beetles); removing snails indirectly affects other useful animals
- snails are part of our biological diversity and many species are endangered nowadays.

Implementation

- places with large numbers of snails are shady and semi-shady areas of the garden with various assorted plants as well as the edges of paths and wooded areas with lots of hiding places (piles of leaves, pieces of wood, flat stones etc); the chances of finding snails can be greatly increased by putting boards directly on the damp ground in the morning.
- turn over all loose items on the ground (fallen leaves, wood and bark pieces, flat stones), and also look in small holes, cracks and around clumps of moss.
- time of day: snails are most active and you can make the largest collection on days when the ground is wet (after rain) or in the early morning hours.
- look in small bodies of water for snails and other shells.
- collection: the brown Portuguese slug is the most common; so that the pupils do not collect too many of the same species, tell them to take only one example of each type of snail.
- identify the snails you have found as best you are able
- write down the number of each species you have found

For the following activities you can keep using the larger snails in a suitable container (for example a large jam jar with holes in the lid which has damp grass and leaves inside).

Alternatively the pupils can collect larger snails themselves as homework.

Building a snail terrarium

Implementation

- Place a layer of garden soil, stones, leaves, moss orsimilar items in the bottom of the aquarium. Sandy, dry soil is not suitable.
- Place some thicker sticks in the aquarium for "climbing" on.
- You must always keep the snail terrarium damp. Use a spray bottle to help, but avoid a build-up of water.
- It is best to use mosquito netting with Velcro strips to keep the snail terrarium completely closed.
- The snails should always have food on offer such as lettuce, dandelion leaves or young vegetable plants. Remove old and wilted leaves regularly.
- As well, the snails need lime. It is best to use cuttlefish, egg shells, pieces of chalk or distribute food containing lime in the terrarium. If the snails do not get enough lime they will suffer from brittle shells among other things.
- Put the snail terrarium in a cool place without direct sunshine.

Opportunities for observation

- Way of feeding and the food they prefer
- Way of moving
- Amount of activity depending on the time of day
- Places the snails retreat to

Season:

Grade level:

Development:

Aims of the activity

- To build a snail terrarium for observing snails
- To practise handling living animals responsibly

Materials

- An aquarium (alternatively a large, transparent plastic container
- Garden soil
- Pebbles, stones
- Moss, leaves
- Mosquito net with Velcro strips (cover for the terrarium)
- Sticks for climbing
- Spray bottle with water
- Food: lettuce, dandelion leaves, young vegetable plants
- Additional Materials A 3_1 **Outer features of snails and slugs**
- If you keep them for a longer time: lime (cuttlefish, which can be bought for example at pet shops, cooked egg shells, white chalk of food containing lime for small animals)

Measuring, weighing and drawing snails

Implementation

Measuring

- Measure a snail (length, width, height of the shell) and write down the results in an observation report.

Weighing

- Weigh the snail and write down the weight

Drawing

- Examine the snail in detail with a magnifying glass (skin, feelers, eyes, breathing hole)
- Draw the snail (depending on the class level this will vary in accuracy, for example at primary school level concentrate on the main points: foot, shell, feelers. At secondary school level you can place more importance on and exact drawing and details.

Season:

Grade level:

Development:

Aims of the activity

- To practise methods of drawing, measuring, observing and keeping a report

Materials

- Snails
- Ruler
- Letter scales, kitchen scales, diet scales or similar
- Magnifying glass (10 x magnification)
- Pencils for drawing (alternatively a camera)
- Observation report
- Additional Materials A 3_1 **Outer features of snails and slugs**

A snail's movement

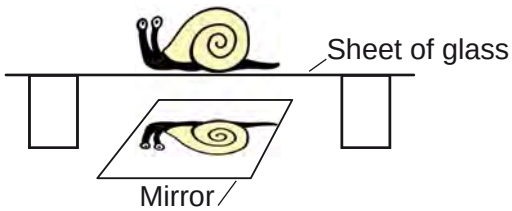
Implementation

a) Observe a snail's movement

- Put a snail on a sheet of glass.
- Put the sheet of glass on wooden blocks or on matchboxes (approximately 5 cm high).
- Put a mirror underneath.
- In the mirror you can see the snail's foot from underneath when it is moving.
- Alternatively you can lift up the sheet of glass and observe directly from underneath.

b) Calculating a snail's pace

- Put a snail on a sheet of glass and mark the starting point with a marking pen.
- Measure the time; let the snail crawl for a minute.
- First of all, draw the path the snail has taken with a marking pen.
- Then lay a piece of wool or string on the path you have drawn.
- Measure the length of the string with a ruler; the result is the number of centimetres travelled in a minute
- Depending on the class level: calculate the speed in km/h, metres per day or similar



Season:

Grade level:

Development:

Aims of the activity

- To observe a snail's way of moving
- To determine the speed of the movement

Materials

- Sheet of glass
- Wooden blocks or matchboxes to hold the sheet of glass up
- Mirror
- Ruler
- Marking pen
- Wool or parcel string
- Stopwatch

Snail slime

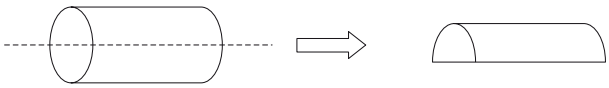
Factual information

The production of slime changes to suit the particular ground. The animal glides along on the slime like on a cushion. This even works on a sharp blade. On Rough surfaces the slime trail is noticeably thicker than on a smooth surface. Snails can even crawl over a kitchen grater without hurting themselves.

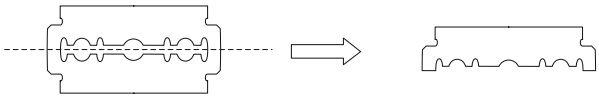
Implementation

Preparation by the teacher:

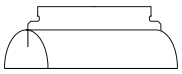
- cut the cork in half lengthways



- break the razor blade in half **(be careful, it is very sharp!)**



- cut the cork half lengthways along the top and push one half of the razor blade into the cut (sharp side upwards)



Experiment 1

- Put the blade in front of the snail and attract the snail with food, so that it crawls by itself over the blade.
- You must not touch the snail while it is sitting on the razor blade!
- To make it more stable, you can fix the cork to the surface (with pins, glue, adhesive tape or similar)

Experiment 2

- Put the snail on various surfaces (kitchen grater/ sandpaper, sheet of glass), then compare the slime trail and discuss.

Season:

Grade level:

Development:

Aims of the activity

- To observe the movement of snails and the protective effect of snail slime

Materials

- White or Brown-lipped snails. Only use Roman (Burgundy) snails for experiments without sharp blades because this species can injure itself more easily.
- Sharp knife which has been placed with the blade upwards in a piece of wood. Alternatively (because it is more spectacular) use razor blades which have been attached to wine corks (see the illustration).
- Food to attract the snails
- Adhesive tape
- Kitchen grater, alternatively sandpaper as well as a smooth sheet of glass

Perform sampling only under a teacher's supervision

A snail's senses

Factual information

Snails can perceive nearby movements because of their ability to detect light. They mostly stop crawling then and begin to retract their feelers and then their head. If a shadow falls on them very quickly, a reflex causes them to retreat into their shell. This biological sense of the so-called shadow reflex is a reaction to a possible attack by predators.

The whole skin of the snail is sensitive to touch. In the case of strong or repeated stimulation the snail will retreat into its shell.

It is difficult and not really possible to completely separate the sense of smell and sense of taste in snails. Therefore you can describe those senses collectively as a chemical one. The feelers, the lips and the edge of the foot above all are sensitive to chemicals, the foot particularly at the front edge. In the case of very unpleasant substances like vinegar you can observe a foaming used as a protective mechanism.

Implementation

Experiment 1 – Perception of light

- Put the snail on damp paper.
- At the beginning, the snail must be crawling with its feelers fully extended (and the observers must be **as quiet as possible!**).
- In normal daylight quickly make a shadow over the snail with your hand. The shadow reflex causes the eyes on the feelers to retract and often the whole snail retreats into its shell.
- Then wait until the snail is crawling again or experiment with another crawling snail.
- Shine a flashlight onto various parts of the snail's body.
- Observe and write down the snail's reaction.
- Make conclusions about the position of the organs of light perception: the eyes are on the ends of the feelers, further cells which perceive light are distributed over the whole body. These have a protective function against predators.

Experiment 2 – Sense of touch/being touched

- Carefully touch the snail on different parts of its body with a glass rod or blunt pencil.
- Observe and write down the snail's reaction.
- Make conclusions about the position of the organs of touch: they are mostly situated in the head region but you can find areas that react to being touched along the whole foot. The part that you have touched usually retracts quickly. This is also a protective function against predators.

Season:

Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug

Grade level: PS JHS SHS

Development:

Aims of the activity

- To examine a snail's senses
- To document and evaluate results
- For the upper classes: to independently plan experiments concerning a snail's senses, to carry them out and evaluate the results (Additional materials A6_1 and A6_2

Materials

Experiment 1: Perception of light

- Flashlight (not a LED lamp, because the light is too bright)

Experiment 2: Sense of touch/being touched

- Glass rod or blunt pencil

Experiment 3: Sense of smell/taste

- Sugar water, water with artificial sweetener
- Vinegar, lemon juice, perfume or other strongly smelling liquids
- Samples of food (lettuce leaves, dandelion leaves, pieces of fruit, …)
- Cotton buds

Experiment 4: Sense of temperature

- Two glasses (volume of approx. 0.2 L), one filled with cold water (c. 15deg C) and the second filled with warm water (c. 40deg C)
- Plastic ruler

Experiment 5: Sense of position

- Straw or wooden stick, 1 cm diameter
- Two piles of books

Experiment 3a) Sense of taste: Sense of taste when looking for food

- In den Weg einer kriechenden Schnecke einen Tropfen Zuckerwasser träufeln. Sobald sie mit der Sohle den Tropfenrand berührt, hält sie an und saugt das Zuckerwasser ein. Ein entsprechender Tropfen mit künstlichem Süßstoff wird abgelehnt.
- *Put a drop of sugar water in the path of a crawling snail. As soon as its foot touches the edge of the drop it stops and begins to suck up the sugar water. Another drop of water sweetened with artificial sweetener is rejected.*
- Place several sample of food at a greater distance (approx. 30 cm) from the snail.
- Observe and write down the snail's reaction.
- Make conclusions about snails' sense of smell": The sense of smell is strong, the organs of the sense of smell are mostly in the head area, and snails move purposefully towards a source of food.

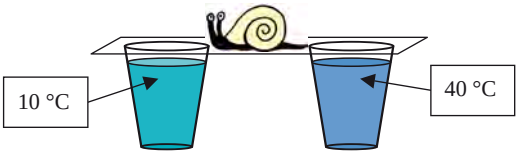
Fig. 7: The foaming of this Roman (Burgundy) snail is a protective reaction against unpleasant substances and can also be used against predators.

Experiment 3b) Reaction to unpleasant substances

- Dip a cotton bud in vinegar and draw a line with this directly in front of the snail.
- Alternatively you can draw a circle of scent around the snail.
- Observe and write down the snail's reaction.
- Make conclusions about snails' sense of smell: Snails have a strong sense of smell, the organs of the sense of smell are mostly in the head area, and snails avoid the smells of substances that they find unpleasant.

Experiment 4: Sense of temperature

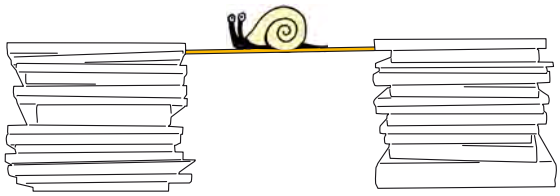
- Fill two glasses to the top with water of different temperature (10 °C, 40 °C) and put a plastic ruler over the top.
- Put the snail on the ruler in the middle between the two glasses.



- Observe and write down the snail's reaction.
- Make conclusions about snails' sense of temperature: snails avoid high temperatures, as protection against drying out they prefer a cool environment.

Experiment 5: Sense of position

- Wedge a straw, wooden stick, thin twig or similar between two piles of books



- Put a snail on the straw.
- Observe and write down the way the snail moves.
- Change the position of the snail (put the front upwards, downwards, turn it on its head etc).
- Observe and write down the snail's reaction.
- Make conclusions about snails' sense of position: For this balancing act the snail must be able to recognise the position it is in.

Observe a snail's food intake

Implementation

- Put a snail on a sheet of glass and offer it various samples of food.
- Observe the snail's reaction and describe the preferred type of food: snails mostly feed on plants but not exclusively.
- Observe the snail from underneath the sheet of glass when it is feeding: you can see its rasping tongue (radula).
- Make a feeding mixture from flour and water and put some on your finger. Feed the snail with this: you can also feel the radula working.

Season:

Grade level:

Development:

Aims of the activity

- To observe snails when feeding
- To recognise the function of the radula
- To determine the preferred type of food of snails

Materials

- Sheet of glass or Perspex about the size of an A5 sheet of paper; put adhesive tape on any sharp edges
- Snails
- Samples of food: dandelion, lettuce leaves, feeding mixture (made of flour and water), pieces of fruit, sausage, cheese, pieces of bread, pieces of cucumber

Diversity among snail shells

Fig. 8: There is an enormous diversity among the Shells of the Brown lipped-snail (*Cepaea nemoralis*). This also applies to the White-lipped snail (*Cepaea hortensis*) which is not pictured.

Season:

Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug

Grade level:

PS JHS SHS

Development:

Aims of the activity

- To discover diversity of colour and pattern in snail shells
- To recognise the importance of this diversity

Materials

- Empty shells of the common banded snails (especially the banded wood snail and the white lipped banded snail). **Check carefully that the shells really are empty!**
- Notebook and pencil

The mysterious diversity among lipped snails demonstrates a key principle of evolution – diversity within a species. The Brown-lipped snails and the white-lipped snails are a supreme example of this principle. They are among the most diverse snails anyway. The difference between these two lipped-snail species can be determined by the dark band (lip) at the edge of the shell which is always present in the banded wood snail but never in the white-lipped snail. The more common species is the species with the black lip. The extreme diversity of colour which can be observed in both species depends on natural selection by predators and also other environmental factors. This phenomenon is based on a genetic process (called polymorphism).

Thrushes are the main enemy of lipped snails. Thrushes can find non-lipped snails more easily in the thick plant growth of a meadow. Having bands (lips) is in this case an advantage which allows better camouflage. The banding also has a disadvantage: a dark shell absorbs heat radiation, a light yellow or pink shell reflects heat better. The colour of the shell therefore influences the temperature of the snail inside it. For this reason, lipped snails with dark banding can be more often found in forests and other shady places.

Implementation

- This can be carried out at any time during the year when there is no snow on the ground.
- Collect snail shells together with the pupils. You can find lots of empty snail shells in semi-shady areas among and under wood in gardens that are close to a natural state, and around the edges of forests and fields and wetlands. Alternatively ask the pupils to collect snail shells as part of their homework.
- For pupils from junior high level onwards, the connection with the habitat is also interesting. Possible question: how many non-lipped, lightly lipped and strongly (darkly) lipped shells come from which habitat? Discuss with the pupils what reasons diversity in shells of

the same species could have. Dark shells are mostly found on shady, dark ground under wood or in the forest. Light-coloured shells (yellow to pink coloured) are mostly found in warmer, open areas where there are lots of hiding places.

- Display all the shells that have been collected, sorted according to colour and pattern.

Snails I

Burgundy snail

3 – 5 cm

Brown-lipped snail

18 – 25 mm (rarely up to 30 mm)

White-lipped snail

14 – 20 mm (rarely up to 22 mm)

Fruticicola fruticum

13 – 23 mm

Perforatella incarnatus

13 – 16 mm

Lapidary snail

12 – 20 mm

Copse snail

14 – 28 mm

Eastern heath snail

14 – 20 mm

Western heath snail

9 – 25 mm

Cheese snail

11 – 15 mm

Cellar snail

9 – 12 mm

Wide mouthed glass snail

8 – 11 mm

Mask snail

7 – 11 mm

Amber snail

6 – 8 mm

Black gloss snail

6 – 7 mm

Mountain Bulin Snail

6 – 7 mm

Ear-shaped glass snail

6 – 7 mm

Pelucid glass snail

4,5 – 6 mm

Garden disc snail

5 – 7 mm

To examine small snails better some are shown bigger

shortest – longest observed animals (size of the shell)

Attention: For species with tower-shaped shells the height information can be found on the backsite of this sheet

Hairy Snail

5 – 12 mm

Petasina unidentata

5 – 8 mm

Further information about the snails illustrated in Identification handout Snails I

Species	H x w (c. in mm)	Identifying features	Habitat	Way of living	RL BY
Roman (Burgundy) snail *Helix pomatia*	30 - 50 x 30 - 50	Largest snail	Sparse forest, hedges, bushes, tall herbaceous vegetation	Likes lime, can get fairly old, sometimes over 20 years	-
Brown-lipped snail *Cepaea nemoralis*	10 - 17 x 18 - 25 (rarely -30)	Spherical, slightly depressed shell; 2 main colours and 5 dark bands (lips) in various combinations, can blend into one another; edge mostly dark brown	Fairly wide range of biotopes (including forest, bushes, hedges, tall herbaceous vegetation	Mostly higher up in trees, bushes etc	-
White-lipped snail *Cepaea hortensis*	12 - 22 (rarely -30) x 14 - 20 (rarely -22)	Spherical, slightly depressed shell; 2 main colours and 5 dark bands (lips) in various combinations, can blend into one another; edge of the opening mostly white	Fairly wide range of biotopes (including forest, bushes, hedges, tall herbaceous vegetation	Mostly higher up in trees, bushes etc	-
Copse snail *Arianta arbustorum*	10 - 22 x 14 - 28	Spherical shell with yellow-brown spots and usually 1 dark brown band on the outside of the spiral	Wide range of biotopes, in forests and open areas.	In plants and trees	-
Fruticicola fruticum	10 - 19 x 13 - 23	2 main colours, pale yellow and reddish brown, in both variations a brown band on the edge of the spirals is possible	Forests, hedges, bushes, tall herbaceous vegetation, reeds	Prefers warm, humid climate; sensitive to dry periods	-
Perforatella incarnatus or *Monachoides incarnatus*	9 - 11 x 13 - 16	Shell with characteristic structure (tapered rods on both sides – magnifying glass); edge of the opening is red	Mostly in forest biotopes, hedges and bushes	Adult animals are mostly on the ground, young also in vegetation	-
Lapidary snail *Helicigona lapicida*	7 - 9 x 12 - 20	Flattened shell with a strong keel, with grainy structure (magnifying glass)	Rock and wall biotopes, areas of old trees in structure-rich forest or hedges	Mostly hiding in cracks and crevices	V
Cheese snail *Helicodonta obvoluta*	5 - 7 x 11 - 15	Flat and tightly wound, brown shell	Forests and hedges	In leaf litter and deadwood; likes lime	-
Eastern heath snail *Xerolenta obvia*	5 - 12 x 14 - 20	Strongly flattened shell, the spiral is hardly raised; shell colour is chalky white with dark brown or nearly black bands	Open, dry biotope (dry grassy areas, embankments, areas of waste ground)	Likes lime	-
Western heath snail *Helicella itala*	5 - 12 x 9 - 25	Strongly flattened shell, the spiral is hardly raised; shell colour is white to pale yellow, mostly with pale brown bands	Open, wet-dry to dry biotope	Likes lime	-
Cellar snail *Oxychilus cellarius*	~ 6 x 9 - 12	Light brown, translucent, flat shell	Moderately damp areas, also deciduous forest	Lives in the leaf litter	-
Wide mouthed glass snail *Aegopinella nitens*	5 - 7 x 8 - 11	Greeny-brown, translucent shell with slightly raised spiral and very much wider last coil	Moderately damp to damp areas, including forests	Lives in the leaf litter	-
Mask snail *Isognomostoma isognomostomos*	4 - 7 x 7 - 11	Depressed spherical shell with characteristic chalky protrusions ("teeth") which project into the opening	In structure-rich forests of the montane level	Mostly under deadwood, in leaf litter or scree	-
Amber snail *Succinea putris*	10 - 17 x 6 - 8	Thin, translucent light – mid brown shell with rapidly expanding whorls	Various damp and wet biotopes	Climbs up vegetation	-
Black gloss snail *Zonitoides nitidus*	3 - 4 x 6 - 7	Glossy shell with slightly raised spiral. The dark grey to black soft part of the body makes the living animals look nearly black.	Wide range of damp to wet biotopes	In the leaf litter	-
Mountain bulin snail *Ena montana*	1,5 -< 2 x 6 - 7	Conical, very solid shell	Structure-rich, damp deciduous forest (and wetland forest)	Mostly on tree trunks or on low-growing plants. The young animals are camouflaged in soil and leaf litter.	-
Ear-shaped glass snail *Eucobresia diaphana*	2,5 - 3 x 6 - 7	Thin, transparent, strongly reduced ear-shaped shell	Moderately damp to damp areas (forest, tall herbaceous vegetation, reeds)	Lives in the leaf litter	-
Pellucid glass snail *Vitrina pellucida*	3,5 - 5 x 4,5 - 6	Thin, transparent, spherical, strongly reduced shell, into which the animals cannot fully retract itself	Various moderately damp areas (including forests, fields)	Lives in the leaf litter	-
Garden disk snail *Discus rotundatus*	~ 2 x 5 - 7	Disk shaped, ribbed shell, brown with red spotted pattern	Various, mostly moderately damp to damp biotopes (including forests, hedges etc)	Lives on the ground	-
(Common) Hairy snail *Trochulus hispidus*	5 - 6 x 5 - 12	Depressed shell with flatly conical to slightly raised spiral. The young animals have thick, short hairs.	Mostly moderately damp biotope, also in crop areas	In the leaf litter or on low-growing plants	-
Petasina unidentata	4 - 6 x 5 - 8	Spherical conical formed shell, mostly with chalky horns ("teeth") at the opening. Young animals have thick hairs, the adult often have gaps in the hairs or they are worn away.	In vegetation in damp forests, also in mountain regions	In the leaf litter or on low-growing plants as well as under deadwood	3

Explanations: **~** = approximately.; **=<** = scant; **=>** = abundant, at least
Endangered species: RL BY (= Red List Bavaria): 3 = endangered; V = warning stage

Snails II

Plaited door snail
c. 4 mm

Thames door snail
3,5 – 4 mm

Clausilia rugosa parvula
c. 2 mm

Rayed glass snail
3,5 – 4 mm

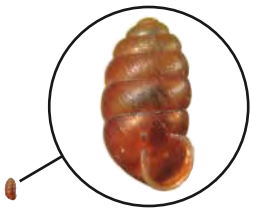
Chrystal snail
3 – 4 mm

Brown hive snail
2,5 – 3,5 mm

Glossy pillar snail
2,5 – 3 mm

Ribbed Vallonia snail
2 – 3 mm

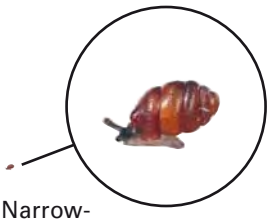
Lovely Vallonia snail
2 – 3 mm



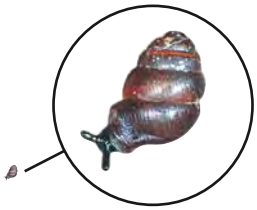
Moss snail
c. 2 mm

Toothless column snail
c. 1,5 mm

Cylindrical whorl snail
c. 1 mm



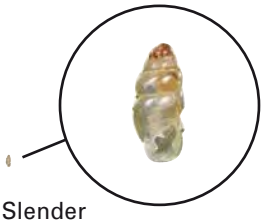
Narrow-mouthed whorl snail
about 1 mm



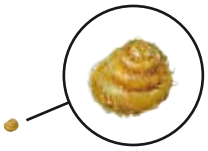
Marsh whorl snail
about 1 mm

Crested vertigo snail
c. 1 mm

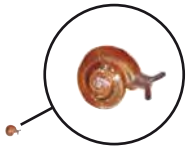
Short-toothed herald snail
c. 1 mm



Slender herald snail
about 1 mm



Prickly snail
c. 2 mm



Smooth coil snail
1 – 1,5 mm

To examine small snails better some are shown bigger

shortest – longest observed animals (size of the shell)

Attention: For species with tower-shaped shells the height information can be found on the backsite of this sheet

Further information about the snails illustrated in Identification handout Snails II

Species	H x w (c. in mm)	Identifying features	Habitat	Way of living	RL BY
Plaited door snail *Cochlodina laminata*	~ 15 x ~ 4	Slim, glossy shell shaped like a high tower	Forests, hedges and bushes	In damp conditions several metres up tree trunks. Feeds on algae and lichens	-
Thames door snail *Balea biplicata*	15 - 20 x 3,5 - 4	Shell with sharp ribs, shaped like a high tower	Various, mostly moderately damp to damp biotopes	In the leaf litter and on low-growing plants as well as on trees, walls etc	-
Clausilia rugosa parvula	=< 10 x ~ 2	Slim, almost smooth shell, shaped like a high tower	Mostly moderately damp rock biotopes, forests, open areas; also walls and hedges	Feeds on algae and lichens	-
Rayed glass snail *Nesovitrea hammonis*	~ 2 x 3,5 - 4	Covered with fine radial lines, glossy shell	Various moderately damp to damp places	Lives in the leaf litter	-
Crystal snail *Vitrea crystallina*	2 - 2,5 x 3 - 4	Thick, disk-shaped, tightly coiled shell with slightly raised spiral; transparent	Various biotopes, especially damp ones	Lives in the leaf litter	-
Brown hive snail *Euconulus fulvus*	2 - 3 x 2,5 - 3,5	Depressed conical shell, finely striped on the upper side; because of this silkily shiny	Forests	Lives in the leaf litter, doesn't mind acid conditions	-
Glossy pillar snail *Cochlicopa lubrica*	5 - 8 x 2,5 - 3	Smooth, long egg-shaped shell	Moderately damp to damp places, including fields, wetlands, tall herbaceous vegetation, forests	Lives in the leaf litter	-
Ribbed Vallonia snail *Vallonia costata*	~ 1 x 2 - 3	Disk-shaped shell with (in fresh condition) sharp, very regularly arranged ribs	Exposed open places; also in sparse, warm forests	In the leaf litter and in loose soil	-
Lovely Vallonia snail *Vallonia pulchella*	~ 1 x 2 - 3	Disk-shaped, mostly smooth shell; freshly glossy and transparent	Partially dry or dry grassy areas; also in sparse, warm forests	In the leaf litter and in loose soil	-
Moss snail *Pupilla muscorum*	3 - 4 x ~ 2	Cylindrical egg-shaped solid shell, mostly with black chalky elevations in the opening ("teeth")	Open, lime-rich places	Lives on the ground	3
Toothless column snail *Columella edentula*	2,5 - 3 x ~ 1,5	Conically cylindrical shell	Moderately damp to damp places, including wetlands, tall herbaceous vegetation, forest	In the leaf litter and on low-growing plants	V
Cylindrical whorl snail *Truncatellina cylindrica*	~ 2 x ~ 1	Slim cylindrical shell with regular, fine ribs.	Sunny places with poor ground	Likes lime, xerophile (can live without much water)	V
Narrow-mouthed whorl snail *Vertigo angustior*	=< 2 x =< 1	Spindle-shaped, narrowly striped shell wound to the left; 5-6 teeth (magnifying glass), one of which is distinctive at the outer side of the opening	Damp to wet open places	Lives in the leaf litter, does not climb vegetation much	3
Marsh whorl snail *Vertigo antivertigo*	~ 2 x => 1	Compact, egg-shaped, shiny shell with characteristic chalky elevations in the opening (6-10 "teeth", magnifying glass), shell wound to the right	Wet open areas, especially near bodies of water	In the leaf litter and on the lower leaves of plants	3
Crested vertigo snail *Vertigo pygmaea*	~ 2 x ~ 1	Cylindrical egg-shaped, irregularly striped shell with characteristic chalky elevations in the opening (4-7 "teeth", magnifying glass), shell wound to the right	varying amounts of dampness	In the leaf litter and on the lower leaves of plants	V
Short-toothed herald snail *Carychium minimum*	~ 2 x ~ 1	Spindle-shaped, glossy transparent shell	Wet biotopes	Lives in the leaf litter	V
Slender herald snail *Carychium tridentatum*	~ 2 x =< 1	Slim, conical shell	Varied biotopes	Lives in the leaf litter	-
Prickly snail *Acanthinula aculeata*	~ 2 x ~ 2	Conical, compact shell with characteristic pointed, drawn out, lamellar ribs	Forests, hedges, bushes	Lives in the leaf litter	V
Smooth coil snail *Punctum pygmaeum*	=< 1 x 1 - 1,5	Fine, regularly striped, flat shell	Varied biotopes, generally with moderate dampness	Mostly lives in the leaf litter	-

Explanations: **~** = approximately.; **=<** = scant; **=>** = abundant, at least
Endangered species: RL BY (= Red List Bavaria): 3 = endangered; V = warning stage

Slugs

Black keel back slug

10 – 20 cm (rarely up to 30 cm)

Dusky slug

5 – 7 cm

Grey field slug

3,5 – 5,5 cm

Great grey slug

10 – 15 cm (occasionally larger)

Lemon slug

3 – 5 cm

Red Slug

12 – 15 cm (occasionally larger)

Darkfaced
arion slug

3 – 5 cm

Marsh slug

1,5 – 2,5 cm

Portuguese slug

8 – 14 cm

Scale in 1:2
Huge animals are shown smaller

shortest – longest
observed animals

Further information about the snails illustrated in Identification handout Slugs

Species	L (c. in mm)	Identifying features	Habitat	Way of living	RL BY
Black keel back slug *Limax cinereoniger*	100 - 200 (rarely - 300)	Grey-brown with spotted striped pattern to completely black; sole in 3 parts; sides of adult animals grey to black, light in the middle	Structure-rich forests	Active at twilight and at night; in crevices in trees, under deadwood etc	-
Great grey slug *Limax maximus*	100 - 150 (occasionally larger)	Light brown to grey with striking striped and spotted pattern, sole plain and light coloured	Varied biotopes, often near to human settlement	Active at twilight and at night; in crevices in trees, under deadwood or in old boards etc	-
Portuguese slug *Arion lusitanicus*	80 - 140	Colour of adult animals mid to dark brown, sometimes reddish, sole mostly dark grey. Young animals brown-olive with striking brown patterning	Diverse cultural biotopes, increasingly crossing over to natural biotopes	In contrast to the native red slug no summer dormancy – competitive advantage; eats the eggs of other snails	-
Red slug *Arion rufus*	120 - 150 (occasionally larger)	Colour of adult animals varies: red, orange, brown, black; sole mostly light grey. Young animals mostly plain yellow, light orange, occasionally with pale bands	Diverse, mostly moderately damp biotopes (forests, hedges, fields)	In low-growing plants and under deadwood	3
Dusky slug *Arion fuscus*	50 - 70	Ochre-yellow to orange-brown, mostly with brown banding pattern	Needle and deciduous forests, also hedges or bushes	On the ground, under deadwood and climbing trees	-
Grey field slug *Deroceras reticulatum*	35 - 55	Light cream-coloured to brownish, mostly with darker spotted patterning	Diverse cultural biotopes	In low-growing plants	-
Lemon slug *Malacolimax tenellus*	30 - 50	Brownish to orange-yellow	Deciduous and needle forest	Feeds on fungi and others, algae and lichens	-
Dark-faced arion slug *Arion distinctus*	30 - 50	Dark grey to yellowish-grey with light yellow sole	Open areas among others	In the leaf litter and on low-growing plants	-
Marsh slug *Deroceras laeve*	15 - 25	Mid to dark brown, mostly with weak spotted pattern	Wet biotopes	Can spend long amounts of time in water	-

Explanations: Endangered species: RL BY (= Red List Bavaria): 3 = endangered

Water snails

Lister's river snail

2,5 – 3,5 cm

Great ramshorn snail

2 – 3,5 cm

Big-ear radix snail

1 – 2 cm

Common ramshorn snail

1 – 2 cm

Great pond snail

1,5 – 3 cm

Common pond snail

1 – 2 cm

Keeled ramshorn snail

1 – 2 cm

Stagnicola fuscus

6 – 12 mm

Faucet snail

5 – 7 mm

Fountain bladder snail

4 – 7 mm

Whirlpool ramshorn snail

6 – 10 mm

Lake limpet

4 – 7 mm

White ramshorn snail

4 – 7 mm

Moss bladder snail

4 – 6 mm

River limpet

3,5 – 6 mm

Twisted ramshorn snail

3 – 6 mm

European stream valvata

3 – 4 mm

Flat valve snail

2 – 3,5 mm

Lesser pond snail

2 – 4 mm

Small snails are shown bigger

shortest – longest observed animals (size of the shell)
Attention: For species with tower-shaped shells the height information can be found on the backsite of this sheet

New Zealand mud snail

2 – 3 mm

Further information about the snails illustrated in Identification handout Water snails

Species	H x w (c. in mm)	Identifying features	Habitat	Way of living	RL BY
Lister's river snail *Viviparus contectus*	30 - 45 x 25 - 35	Greeny-brown to dark brown shell, mostly with 3 red-brown bands; shell pointed at the top (test this); corneous cover	Still waters with many plants in the Danube catchment area, Swabian-Bavarian hills, lakes in the alpine foothills	Feeds on green plants, also filters particles from the water; ovoviviparus	3
Great ramshorn snail *Planorbarius corneus*	~ 10 x 20 - 35	Disk-shaped, sold shell; brown, often with greenish or blackish coatings	Still and slowly flowing waters	Feeds on detritus	-
Great pond snail *Lymnaea stagnalis*	30 - 60 x 15 - 30	Shell tapering to a point, with much wider last coil; young have a slim conical shape	Still and slowly flowing waters with much plant material	Grazes on aufwuchs (algae) and feeds on plant matter and detritus	V
Big-ear radix snail *Radix auricularia*	15 - 25 x 10 - 20	Shell with small, pointed spiral and a much wider last coil	Still and slowly flowing waters	Feeds on plant matter and detritus, grazes on aufwuchs (algae)	-
Common ramshorn snail *Planorbis planorbis*	2 - 3 x 10 - 20	Spiral shell coils on one level; keel or edge on the outside, mostly towards the upper side, seldom in the middle	Still and slowly flowing waters, sometimes with muddy bottom, smaller bodies of water	Feeds on algae growth and rotting plant matter	V
Common pond snail *Radix balthica*	10 - 20 x 10 - 15	Shell with much larger last coil	Various still and slowly flowing smaller bodies of water, seldom in larger flowing waters	Feeds on plant matter and detritus, grazes on aufwuchs	-
Keeled ramshorn snail *Planorbis carinatus*	1 - 3 x 10 - 15	Spiral shell coils on one level; sharp keel in the middle of the outside	In the water plant belt of still and slowly flowing, mostly larger waters	Feeds on detritus	V
Stagnicola fuscus	10 - 25 x 6 - 12	Tall, conically shaped shell with fairly flat coils	Still waters with much plant material	Feeds on rotting plant material, grazes on the ground	V
Whirlpool ramshorn snail *Anisus vortex*	~ 1 x 6 - 10	Tightly spiralled, thick disk-shaped shell	Still and slowly flowing waters with much plant material	Feeds on algae growth and rotting plant material	V
Faucet snail *Bithynia tentaculata*	8 - 11 x 5 - 7	Pointed oval shell with chalky cover	Running and still waters	Grazes and filters detritus. Very adaptable	-
Fountain bladder snail *Physa fontinalis*	7 - 12 x 4 - 7	Very thin-walled, very glossy, yellow-brown shell	Clear, still waters with much plant materials or slow flowing waters with much plant materials	Mostly feeds on detritus, also on algae	V
Lake limpet *Acroloxus lacustris*	1 - 2 x 4 - 7	Bowl-shaped shell, the point is slightly bent towards the left back	Still, rarely slow flowing waters	Grazes for example on water plants, also roots or deadwood in the water	V
White ramshorn snail *Gyraulus albus*	1 - 2 x 4 - 7	Spiral-shaped shell with a lattice structure	Still and slow flowing waters	Mostly feeds on detritus	V
Moss bladder snail *Aplexa hypnorum*	10 - 15 x 4 - 6	Slim, reddish-brown shell shaped like a high tower; strongly glossy when fresh	Temporary and small bodies of water	Feeds on rotting plant matter and grazes the bottom of the water	3
River limpet *Ancylus fluviatilis*	2 - 3,5 x 3,5 - 6	Bowl- or cap-shaped shell with a point bent towards the right back	Flowing waters and the surf zone of lakes	Lives in hard substrate where it grazes on aufwuchs; rheophilic (prefers flowing water)	-
Twisted ramshorn snail *Bathyomphalus contortus*	1 - 2 x 3 - 6	Tightly would spiral-shaped, flat shell with a sharp keel on the outer side	Still and slow flowing waters with much plant material	Feeds on algae growth and decomposing plant matter	V
European stream valvata *Valvata piscinalis*	3 - 5 x 3 - 4	Flat, conical shell with a round opening and cover	At the bottom of flowing waters and larger bodies of still water	Feeds on detritus, needs oxygen	V
Lesser pond snail *Galba truncatula*	5 - 8 x 2 - 4	Slim, pointed conical shell with layered, offset coils	Temporary and small bodies of water, wet fields and marshes	Lives like an amphibian, likes to be out of the water	-
Flat valve snail *Valvata cristata*	1 - 1,5 x 2 - 3,5	Flat, disk-shaped rolled up shell with a round opening and cover	Sill and slow flowing waters, springs	Feeds on detritus, needs oxygen	-
New Zealand mud snail *Potamopyrgus antipodarum*	4 - 6 x 2 - 3	Slim, pointy conical shell with cover	Freshwater (flowing and still waters) and stagnant water	Mostly feeds on detritus; give birth to live young	-

Explanations: **~** = approximately. **Endangered species: RL BY** (= Red List Bavaria): 3 = endangered; V = warning stage

Molluscs

Swan mussel

bis ca. 20 cm

Duck mussel

8 – 11 cm

Painter's mussel

8 – 11 cm

Thick-shelled river mussel
(strictly protected!)

5 – 7 cm

Scale in 1:2
Huge animals are shown smaller

shortest – longest
observed animals

Zebra mussel

2,5 – 4 cm

Asian clam

2 – 4 cm

European
fingernail clam

10 – 12 mm

Greater European
pea clam

7 – 11 mm

Lake fingernail clam

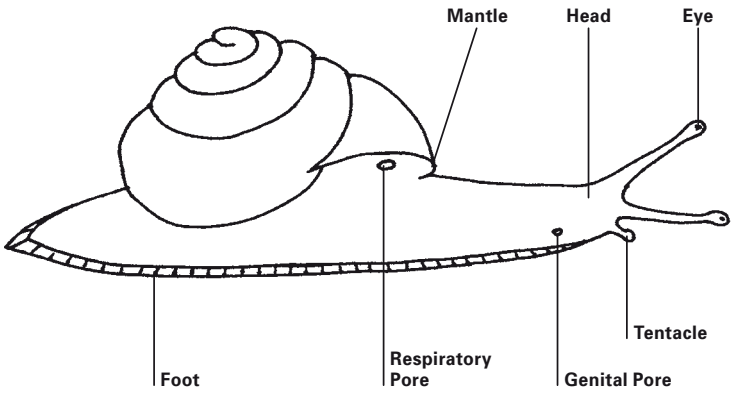
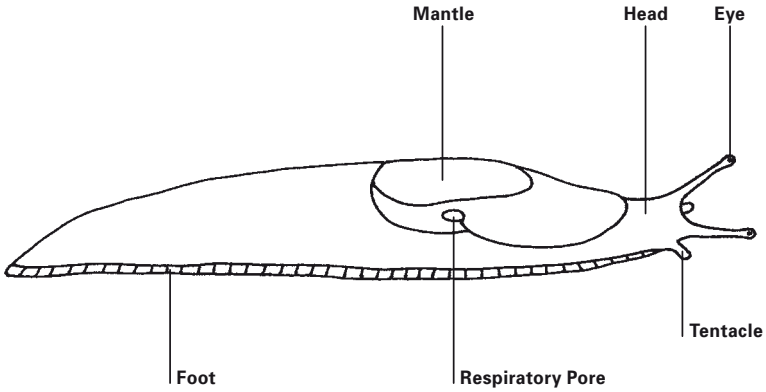
7 – 10 mm

Pea clam
or Pea cockle

3,5 – 5 mm

Further information about the snails illustrated in Identification handout Molluscs

Species	H x w (c. in mm)	Identifying features	Habitat	Way of living	RL BY
Swan mussel *Anodonta cygnea*	80 - 120 x - 200	Longish, egg-shaped, relatively thin shell; upper and lower edges parallel	Larger bodies of still water	Filterer, parasitic larvae (glochidia) cling to the fins of host fish	3
Duck mussel *Anodonta anatina*	50 - 70 x 80 - 110	Rhombus-like, egg-shaped, relatively thick shell, with diverging upper and lower edges	Still and slow flowing waters	Filterer, parasitic larvae (glochidia) cling to the fins of host fish	3
Painter's mussel *Unio pictorum*	30 - 40 x 70 - 100	Elongated, tongue-shaped shell, when fresh greenish-yellow patterning; upper and lower edges almost parallel. Whorl (part of the shell from the juvenile phase) has small, isolated chalky humps	In larger still and flowering waters	Filterer, parasitic larvae (glochidia) cling to the fins of host fish	2
Thick-shelled river mussel *Unio crassus*	30 - 40 x 50 - 70	Elongated elliptical to shorter egg-shaped solid shell with curved upper edge	Previously widespread in streams and rivers with clear, oxygen-rich water; today it is threatened with extinction	Filterer, parasitic larvae (glochidia) cling to the fins of host fish. Juvenile mussels at the bottom of the water sensitive to nitrate	1
Zebra mussel *Dreissena polymorpha*	15 - 20 x 25 - 40	Three-cornered, navicular shell with characteristic banding	Larger still and flowing waters	Filterer, uses byssus threads to attach itself firmly to the substrate	-
Asian clam *Corbicula fluminea*	20 - 35 x 20 - 40	Roundish, three-cornered, thick shell with bold ribs	Rivers and lakes	Filterer. Spreads using free-swimming larvae	-
European fingernail clam *Sphaerium corneum*	8 - 10 x 10 - 12	Roundish-oval, bulbous shell	Still and not too strongly flowing waters	Filterer. Mostly lives on the bottom, but also on water plants	-
Greater European pea clam *Pisidium amnicum*	5 - 7 x 7 - 11	Elongated oval-shaped, strong shell with superimposed ribs	Flowing waters and surf zones of lakes	Filterer. Prefers sandy ground	2
Lake fingernail clam *Musculium lacustre*	7 - 8 x 7 - 10	Trapezoid-shaped roundish shell with crested, offset whorl	Smaller bodies of still water; also slowly flowing waters	Filterer	V
Pea cockle or Pea clam *Pisidium casertanum*	2,5 - 4 x 3,5 - 5	Elongated egg-shaped or triangular shell	Still and flowing waters	Filterer, euryoecious species (have a broad variety of living conditions)	-

Explanations: ~ = approximately.
Endangered species: RL BY (= Red List Bavaria): 1 = threatened with extinction; 2 = critically endangered, 3 = endangered; V = warning stage

Outer features of a snails and slugs