

1. Introduction

Only every third young person between the ages of twelve and fifteen years has ever had a beetle or butterfly on their hand.

A quarter of them have never seen a deer in the wild.

(BRÄMER 2007)

Children and young people recognise on average four of the twelve most common garden birds.

Eight percent don't know any of these birds.

(ZAHNER 2007)

Nowadays many young people know more Pokemon animals than native animals.

(SPITZER 2008)

These statements clearly show the increasing unfamiliarity with nature among children and young people, which is often seen together with a reduction in the knowledge of different species. This distancing from nature was again confirmed by the "Jugend-report Natur" (Young People's Report on Nature) 2010.

This particular publication was created in the context of the "Tiere Live" project, which is looking for ways of confronting these challenges. The fascination created by living animals presents a great opportunity, both in class and in extracurricular education, to tap into children and young people's emotions and to motivate them to accept responsibility and to develop an appreciation for biological diversity, in order to encourage ecologically responsible behaviour.

This publication aims to promote the use of living animals in school lessons and in environmental education outside of school. Animals offer the teachers and environmental educators the opportunity to make knowledge come alive. The suggestions in the publication connect experiences with facts. In this context, living animals are ideal for developing interest, knowledge and appreciation: they offer emotional experiences which encourage learning and can lead to real changes in behaviour and definite actions.

In view of the increasing focus on pupils' competence, the instruction will not be limited to communicating specialised knowledge, but it will also aim to empower the pupils to take part in responsible discussion in society. Therefore evaluating and judging complex biological issues is an important topic, for example acting responsibly towards a variety of species, by means of which these skills can be developed. Activities to achieve these aims are included in this publication. These activities are mainly aimed at senior school pupils.

The activities and materials which are included in this publication are based on the results of activities which have already been successfully trialled with pupils. Importance was placed on giving children and young people the opportunity to get to know animals and to open up knowledge by doing so. Transferring the responsibility for a living creature to the pupils develops their confidence, responsibility and social skills. Handling living animals offers concrete opportunities to accommodate one of the highest aims of the programme, namely the feeling of responsibility for nature and environment.

Native animals especially are included in the suggested activities. Contact with these animals is a prerequisite for a personal relationship and emotional connection between the children and young people and their native environment. The Bavarian Biodiversity Strategy (STMUG 2009) states its aim as being: "The continual increase in appreciation by pupils of their surrounding natural environment and the strengthening of the relationship between the two". It is also stated: "The preservation and utilisation of biological diversity requires the support of the community. The importance of biological diversity is anchored in education both within and outside of school. Efforts should be made to undertake further improvements". The "Tiere Live" project is a contribution toward the implementation of the Bavarian Biodiversity Strategy and is just one part of the work necessary to achieve these aims. It should encourage teachers and environmental educators to include living animals both in their fields of work as well as in their personal surroundings.

The observant exposure to the environment, awareness for the importance of biological diversity and the development of ecological values is a (life-)long process. As individuals we can therefore only determine the success of our attempts with the children and young people who are entrusted to us – for a certain time – in hindsight or not at all. However, this should not prevent us from making our contribution with commitment, courage and confidence.

Our children and young people are tomorrow's generation and we depend on each and every one of them.

2. From knowledge of the environment to action

2.1 The gap between knowledge of the problem and taking action

A survey on environmental consciousness in Germany showed that 96% of people knew about the problem of the loss of diversity of species, but they did not see a connection between their own lives and this problem: only 25% were of the opinion that the loss of diversity affected their own lives (KUCKARTZ 2006). A youth study by Shell (SHELL GERMANY HOLDING 2006) found out that in spite of having a positive outlook on their own lives, young people were pessimistic about the future of the world in general. At the same time, behaviours involving environmental consciousness and conservation were valued much lower than friendship and having exciting experiences. It was observed that young people were drawn more toward behaviours affecting their economic position. Children of primary school age already notice the worrying environmental situation and, following on from that, 11- to 14-year-olds are particularly sensitive to environmental destruction because of their increasing ability to be aware of such problems. Nevertheless, many studies have detected a negative trend with increase in age: the older people become, the less willing they are to be actively committed to protecting the environment (GEBHARD 2009).

These examples show the gap between knowledge of the problem and corresponding behaviour and taking action. There are many reasons for this. The results of our own studies will be shown below.

In the study on environmental consciousness and environmentally-friendly behaviour in the social setting in Germany (WIPPERMAN 2009) it was found that a positive attitude to the environment often conflicted with personal desires, for example the desire to drive a sports car rather than to cut down on driving, or taking holidays in far-away places rather than closer to home. The responsibility for the protection of the environment is often passed on to the government with the reason that this is asking too much of individuals and that an individual cannot change anything on his own. To reflect on one's own behaviour and to draw consequences for one's own actions is seen as being too time-consuming.

From knowledge of the environment to action

Pupils in years 7 to 12 were interviewed in a study by LESKE & BÖGEHOLZ in 2008. The decrease in value-based and intrinsic interest in their natural surroundings is explained by the new interests of the young people. At this age, young people's interests become centred on the development of relationships and friendships as well as on the world of media. Growing up also influences young people's perception of responsibility for protecting the natural environment: older pupils consider the government and industry responsible rather than the individual. The explanation for this is that the pupils' expectation of the success of their own actions is too low and they have too little confidence in their own abilities.

Another study gives the reason for the phenomenon of perceiving the ecological crisis on the one hand but displaying astoundingly casual behaviours on the other hand. The individual's psychological defence mechanisms and ability to ignore the problem are said to be the cause of this (GEBHARD 2009). The feeling that, as an individual, one is not able to influence the threat of the destruction of the environment leads to the situation being played down. Environmental consciousness, which has been given much importance in society, subjectively loses its striking interpretation. This defensive mechanism is also known as "unrealistic optimism" or the "it won't happen to me" phenomenon. It is likely a major reason for the low effectiveness that knowledge of one's environment has on actual environmentally conscious behaviour. In addition, an objective, rationalistic approach is often seen. Dangers to the environment are often recognised and analysed, but this approach does not alter an individual's action significantly, "because the relational, identificatory, emotional side is separated" (GEBHARD 2009, 252).

2.2 Encouraging willingness to take action for the environment

For environmental educators, the question of how to close the gap between awareness of the problem and actual action arises. According to the studies of LESKE & BÖGEHOLZ in 2008, interest in nature, awareness of endangered species as well as exploring and experiencing ecology and nature influences one's willingness to protect biological diversity in a positive way. It is just as important to have a value-based and emotional interest in one's natural surroundings. On the other hand, no positive influence could be found in using media to experience nature (i.e., nature or animal films). The following recommendations can be gained from the study: The development of an awareness of endangered species is fundamental. This is a prerequisite for the perception of a personal responsibility and the willingness to act which results from this. Opportunities for young people to participate encourage them to accept responsibility. Children and young people can develop confidence in their own skills when they are actively exposed to environmental problems and when they find out that their own actions can be effective. The pupils realise they can influence and change situations themselves when they are shown how to identify and implement particular ways of acting.

Being interested in one's natural surroundings is a strong prerequisite for caring for the environment. In terms of developing an interest in nature, both an emotional approach and hands-on experience of nature is useful. It is also important to consider the age of the pupils. Motivating older pupils can be successful if the information is connected to examples from everyday life.

Presenting opportunities to connect with the subject emotionally is important in order to address the problems of the ability to ignore the situation and lack of identification with environmental matters. GEBHARD 2009 proved how important it is for children and young people to identify with animals. Threats to the environment can be experienced when animals are used as figures to identify with. In this way, the destruction of the environment becomes fixed in the minds and senses of the children and young people.

2.3 The importance of environmental knowledge

The often implicitly assumed causal relationship between environmental knowledge, environmental awareness and behaviour affecting the environment possibly only applies to 15-20% of the variance in environmental behaviour (GEBHARD 2009). It is undisputed that skills and special subject knowledge are necessary for acting in an environmentally friendly way; however, the context of this knowledge is crucial. Simply knowing about the destruction of the environment does not automatically cause one to be emotionally concerned and lead to a willingness to act. Compared to this, orienting oneself to ecological values is much more effective in influencing the willingness to act.

Education in and away from school results in a development of knowledge of biology and ecology, but does little towards being emotionally oriented and towards developing values which would lead to a willingness to act. Gebhard recommends "...that knowledge does not remain in isolation, but gets the chance to connect with the emotions and the imagination. Only knowledge that is, so to speak, not free of emotion could lead to action." (GEBHARD 2009, 254)

This doesn't mean that no efforts should be made to educate people about the environment. One should remember, however, that knowledge of the environment – just like knowledge in other subjects – can be "inert knowledge". That means it is knowledge which is accumulated and reproduced by students, but it remains in isolation because it is not used in everyday, real-life situations.

The attention of environmental education should be devoted to connecting ethical reflections with actions. Knowledge of complex ecological contexts receives special significance. The ability to reflect on ecological topics in a reasoning and ethical way is also encouraged. Building on the ideas of the pupils and the identification and discussion of their subjective theories also encourages environmentally friendly actions. It is not only important whether pupils retain knowledge correctly but also how it is mentally stored and whether that knowledge is connected with their imaginations and emotions.

2.4 Recommendations for environmental education in class and in extracurricular situations

To sum up, the following tips and recommendations for pupils can be given:



Fig. 1: To grasp in both senses of the word – for example in this amphibian conservation project – connects one's own actions with perceiving connections.

- Develop everyday learning situations which provide the opportunity to translate knowledge into actions
- Find connections with the lives of and the communication media used by the students
- Take into account the pupils' ideas during lessons; discuss subjective theories
- Develop the pupils' interest with an emotional approach to nature
- Connect complex ecological relationships with actual ways of acting
- Carry out investigations concerning nature outdoors
- Develop ecological consciousness and consciousness of endangered species
- Build up value systems through reflection in a reasoning and ethical way
- Create ways for pupils to participate so they can experience the effects of their own actions
- Make use secondary school pupils' increasing ability to understand problems
- Devote more time at school to the topic of conservation
- Involve parents in environmental education, as the ideas and values of the parents significantly influence children.

3. The “Tiere Live” project

3.1 The approach of the project – the importance of emotions and animals

The “Tiere Live” project is centred on the idea of giving children emotional access to nature through real contact with living animals. The encounter and interaction with animals provides great potential for successful environmental education which should not be passed by. By using this programme of tested materials and information, teachers and environmental educators will be supported in their work with children and young people.

The approach of this project is supported by the results of various studies.

GEBHARD 2009 picks up on the importance of children and young people identifying with animals. The fact that environment is endangered becomes accessible when animals are used as figures to identify with, and this can fix ecological topics in the minds and senses of children and young people. GEBHARD also remarks that “excursions, experiments, direct observations, caring for creatures, simply experiencing nature, all these methods of approach (...) are without doubt a prerequisite to “grasping” natural phenomena.” (GEBHARD 2009, 191)

Zahner’s study sees being emotionally affected by the loss of personal experiences of nature as the key to a change in behaviour (ZAHNER et al. 2007). There is a certain sadness when one doesn’t hear the quail calling in the field any more, and a delight in hearing the first skylark or the first starling which comes back in spring.

Knowledge and opinion are both influenced positively by direct contact and actual experience with animals (KLINGENBERG 2008; GEBHARD 2009).

A systematically guided exploration of nature and ecological experiences, in this case with animals, encourages emotional interest in nature and creates a consciousness for the threats to nature (BÖGEHOLZ 1999, LESKE & BÖGEHOLZ 2008). Living animals provide the ideal prerequisites in this context.

It was also shown that an emotional and caring relationship with animals can also extend to a caring attitude to natural phenomena in general (MYERS & SAUNDERS 2002).

Essential ideas of this project:

- Direct experience with living animals is the focus of a holistic method of education: actual experience with animals connects emotions and actions and offers pupils a way to actively take part and identify themselves with the topic.
- The connection between endangered species, active methods of conservation and positive effects (success) can be most obviously demonstrated with animals (for example, protecting amphibians on roads).
- Caring responsibly for life, for example in the framework of keeping animals (short- or long-term), influences the interpersonal way of acting and the ability to empathise in a positive way. Values can be built up with the help of animals and suitable discussion topics. This opens up the potential for education which is little used at the moment.



Fig. 2: Experiencing how a chick hatches strongly appeals to the emotions.

- Events in nature are events in life: projects involving living animals create personal interest in our surrounding world, rather than abstract lessons that do not have much connection with our immediate environment.

Excerpt: "Favourite" animals and "disgusting" animals

Most pupils' "favourite" animals are ones which you can easily form a relationship with. As a result, the most popular animals are mammals, because you can get to know them in an anthropomorphic way. These animals are sociable, possess facial expression and bodily contact is easy to engage in.



Fig. 3 and 4: Not only "favourite" animals but also "disgusting" animals should be taken into account.

However, the phenomenon of disgust and fear of animals does exist. Gebhard (GEBHARD 2009) mentions that fear and disgust towards certain animals is fairly rare and decreases with increasing age. Rats, spiders, snakes and wasps are mentioned most often in studies. Girls have much stronger feelings of disgust towards animals than boys. It is very probable that the selection of which animals are "disgusting" animals is highly culturally conditioned. This is further supported by the fact that young children have no or almost no feelings of disgust and this reaction of disgust only begins to be apparent at the age of 4 or 5 years.

Concerning the pedagogical way to deal with fear and disgust, Gebhard noticed that fear, disgust and aversion and a corresponding behaviour of avoidance toward animals are everyday occurrences (GEBHARD 2009). He explains this as being a distinct phenomenon which is based on biographical or cultural tradition. The following approach in dealing with pupils' reactions of fear and disgust is helpful: disgust or fear is not an inappropriate behaviour which pupils should learn to manage. From a pedagogical standpoint it is much more important that the pupils' disgust or fear is brought out. You can then prevent fear and disgust from becoming independent and more radical, for example causing disgusting animals to be eliminated. The aim is not to remove feelings of fear or disgust, but rather to bring them into a form that is bearable.

Reports about the use of snails in class show that a normal, everyday method of handling them, where fear and disgust are not masked or even forbidden, reduces strong reactions right at the start and leads to the students becoming used to the creatures. Learning which is aimed at reason is far more successful, being based on this normal method of handling. A kind of "reason" on the other hand, which does not take into account the emotional condition of the pupils, would be without effect, especially when it concerns such fundamental feelings like disgust or fear. Furthermore, it is helpful to arrange the lessons in a way that a feeling of safety is guaranteed, for example by letting pupils decide themselves how close they want to get to the "disgusting" animal. A spider in a glass causes much less fear than one on the table. A decidedly matter-of-fact atmosphere that concentrates on recognising interesting facts as well as using the correct terminology is also a helpful suggestion. Showing a film or a series of pictures first can provide a "practice run" for these feelings which can lessen them in the actual situation (GEBHARD 2009).

The “Tiere Live” project

3.2 The origin of the project

The idea for the cross-departmental publication project “Tiere Live” was developed in a continuing education seminar which was carried out by the Bavarian Academy for Nature Conservation and Landscape Management (ANL) and the Academy for Teacher Training and Personnel Management in Dillingen (ALP). During this seminar it became clear that in order to implement the topic of biological diversity in class and in extra-curricular education, suitable lesson materials were necessary, as was the need to raise awareness of the topic.

The project as a whole is supported by the Bavarian Ministry for Environment and Health and the Bavarian Ministry for Education and Culture.

In a two-year development and research phase, eight teachers from various kinds of schools and one educator as a representative of extracurricular environmental education produced a project handbook. In addition, experts for the respective groups of animals were involved in drafting the chapters.

The website <http://dozenten.alp.dillingen.de/tiere-live/index.php/en> gives information about the project, the project handbook and external contacts for the various animals and offers a moderated forum as well as the opportunity to make an online evaluation.



Fig. 5: The home page of the website Tiere Live.

3.3 The project handbook of “Tiere Live”

The project handbook contains tested activities for use in class in all types of schools and in extracurricular education. These activities are centred on direct encounters with living animals. In the folder there are 64 practical suggestions concerning the 12 groups or examples of animals and two further topics (keeping animals and animal tracks).

Overall goals of the project

- To experience animals “live”
- To get to know and appreciate the wide variety of animals
- To recognise animals as part of one’s natural surroundings
- To recognise the meaning of diversity of species
- To connect emotions with actions
- To illustrate endangered species and how to protect them
- To encourage responsible ways of acting towards animals
- To reduce possible preconceptions concerning animals
- To learn to deal with possible fears and feelings of disgust
- To deliver biological subject knowledge
- To develop evaluation skills
- To develop connected and systematic thinking
- To contribute to the building up of values

These aims were the basis for the guidelines according to which the activities in the project handbook were designed and drafted.

Guidelines for the design of the activities:

- **Discover diversity in your own surroundings.** Activities based on this key aspect can educate pupils about various species and will develop awareness of diversity in their own immediate surroundings. Sections especially concerning recognition of species in Bavaria have been developed, which allow animals to be identified quickly and easily.

- **Take responsibility for living creatures.** A feeling of responsibility among pupils will be developed by the short- or long-term care of animals. Housing animals in the classroom or somewhere else in the school allows knowledge to be gained in a clear and true-to-life way and gives an insight into the development of living creatures.
- **“Nice” and “horrible” animals.** As well as using animals that are well-liked, other groups of creatures are suggested on purpose (for example, bats, snails, earth-worms). These creatures are not regarded as highly and are sometimes connected with negative images. These activities give pupils the chance to learn to deal with fear and disgust, to reflect on their own actions and to build up a system of values.
- **“Problem animals” in our society.** Some of the activities deal with animals (such as the beaver, ravens, or the wolf) that are socially controversial. The prejudices and conflicts of interest of various groups can be introduced and objective scientific data can be presented. These activities give pupils the opportunity to form opinions and make judgments.
- **Putting the suggestions into practice.** The project must ultimately be measured against its feasibility in practice. It therefore contains quick activities that are designed for use in the classroom as well as more time-consuming lessons or field trips which take place outdoors. Attention has been paid to the connections to the curriculum as well as to providing supporting materials for teachers or environmental educators. All the activities have been tested according to legal and health safety criteria.

The project handbook is available from the Bavarian Academy for Nature Conservation and Landscape Management (www.anl.bayern.de; contact Peter Sturm peter.sturm@anl.bayern.de) and from the Academy for Teacher Training and Personnel Management (www.alp.dillingen.de, contact Tanja Berthold, t.berthold@alp.dillingen.de).

The "Tiere Live" project

Literature

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4. Placement of the publication in school environmental education

The present publication can be placed in various contexts within school education.

4.1 Education standards

In the nationwide education standards for biology which were determined in December 2004 by the Ministry of Education there are some references to the aims of this publication, for example:

The pupils....

...explain ecosystems and biospheres as systems. (F 1.3)

...know about and understand the basic criteria of sustainable development. (F 1.8)

...describe and explain how selected organisms adapt to their environment. (F 2.6)

...know about and discuss human intervention in nature and also the criteria for such decisions (F 3.8)

...determine, using appropriate identification literature, common species in an ecosystem. (E4)

...explain dynamic processes in ecosystems using model concepts. (E 12)

...describe and evaluate the keeping of pets and livestock. (B 4)

...describe and evaluate the effects of human intervention in an ecosystem. (B 5)

...discuss opportunities for environmentally sound and environmentally compatible participation in the interests of sustainability. (B 7)

4.2 Guidelines for environmental education in Bavarian schools

The aims of environmental education in Bavarian schools are set down in the "Guidelines for Environmental Education in Bavarian Schools" (2003). These aims are binding. The guidelines are based on Article 131, Paragraph 2, of the Bavarian Constitution, which states that one of the primary educational goals is the "awareness of responsibility for nature and the environment".

It is pointed out in the guidelines that as well as gaining subject knowledge, an important aim is also to gain a respectful and emotionally based understanding of nature and the world around us.

Topics and content in environmental education which are particularly addressed by this publication are:

The importance of the beauty of nature, species diversity, ecosystems

For example: animals in their habitats, the ecological importance of the diversity of species, the basic messages of ecology, the protection of animals, species protection and the protection of biotopes

Natural and cultural landscapes

For example: the regional and global effects of the destruction of natural regions

Sustainable development as an ethical challenge

For example: awe of creation

4.3 Subject curricula in various types of schools

The suggestions and materials of this publication can be used to meet many aims of the subject curricula in various types of schools.

The following table gives examples of appropriate curriculum topics.

Placement of the publication in school environmental education

Type of school, year level	Curriculum topic	Examples of content
Primary school 1	1.5.1 Seasonal changes in a meadow	- to experience the diversity and beauty present in a meadow - to develop respect and responsibility towards plants and animals
Primary school 1	1.5.2 Animals of the meadow	- to differentiate and name certain animals according to their appearance - to determine their preferred habitat - to observe the individual phases of the development of a butterfly
Primary school 2	2.4.2 Keeping a pet	- to know about the needs of a pet - to evaluate the reasons for keeping a pet
Primary school 2	2.5.1 The hedge throughout the year	- to develop respect and responsibility towards plants and animals
Primary school 2	2.5.2 Animals that live in the hedge	- to differentiate and name certain animals that live in hedges according to their appearance - to observe the way of life of certain animals that live in hedges
Primary school 3	3.5.2 Animals that live in the forest	- to differentiate certain animals by their appearance and to name them - to demonstrate food relationships by means of an example
Primary school 3	3.5.4 The importance of the forest	- to develop respect and responsibility towards plants and animals
Primary school 4	4.5.2 Water as a habitat for animals and plants	- to differentiate and name animals near and in water - to observe the adaptations of an animal to life near and in water - to develop respect and responsibility towards plants and animals; to protect waters
Special School (for children with disabilities)	Nature: 2. Life in a community of people, animals and plants	- animals in the house and garden, livestock - biodiversity in the animals world, in the meadow, forest and waters
Special School (for children with disabilities)	Nature: 4. Environment and environmental protection	- soil organisms
Junior High School 5	5.3.1 Mammals in our surroundings	- physique, way of life and typical behaviour of a mammal, shown by the example of a pet - responsibility of people to care for and house animals correctly - mammals in the wild; important common features of mammals
Junior High School 6	6.2.1 Life forms near and in water	- animals and plants near and in waters - exercises to recognise creatures, and simple identification - watching and observing in an environmentally friendly way - a responsible way of handling animals and plants in waters
Junior High School 6	6.2.2 Adaptation of life forms in a water habitat	- fish, amphibians - endangered habitats; connection between the protection of species and the protection of biotopes, protection of waters
Junior High School 7	7.1.4 The air – habitat for birds	- native birds; exercises to recognise creatures; protection of species - adaptation to the habitat of the air
Junior High School 8	8.1.1 Life forms in the ground	- life forms in leaf litter, in compost and in the soil - exercises to recognise creatures

Placement of the publication in school environmental education

Type of school, year level	Curriculum topic	Examples of content
Junior High School 8	8.2.1 Plants and animals in the forest	- plants and animals of the forest, exercises to recognise creatures - insects in the forest
Junior High School 8	8.2.2 Food relationships, cycles of matter	- food relationships in the forest: food chains and food webs
Junior High School 10	10.4.1 Phylogeny and evolution	- phylogeny of life forms
Secondary School 5	5.4 physique and way of life of mammals	- characteristics of mammals, endangered species: reasons for being endangered, ways of protecting these species - mammals as suppliers of food and resources, appropriate methods of caring for these animals - breeding
Secondary School 6	6.2 Phylogenetic development	- common features of vertebrates - diversity of species; responsibility of humans
Secondary School 6	6.5 Forest or meadow community	- distinctive animal and plant species, special adaptations to the habitat - food relationships and one cycle of matter, importance, being endangered and protection - biocenosis, biotope and ecosystem
Secondary School 7	7.3 Programmes and rules for living together	- animal behaviours: examples, particular characteristics and importance
Secondary School 8	8.4 Life communities in waters	- distinctive animal and plant species, special adaptations to the habitat - ecological niches - predator-prey relationship, biological balance - ecosystem - food pyramid - importance of waters, water quality, indicator organisms, threats and protection
Grammar School 5	NT 5.1.2 Topic areas and concepts	- environment and life
Grammar School 5	NT 5.2.3 Physique and way of life of mammals	- an insight into the life of one type of pet and one type of livestock (origin, breeding, type; way of life and adaptation as seen in physique and behaviour; appropriate ways of keeping)
Grammar School 6	NT 6.1.1 Vertebrates in various habitats	- fish, amphibians, reptiles, birds (physique, body temperature and breathing, locomotion, strategies for searching for and consuming food, way of life throughout the seasons, endangering and protection, use by people)
Grammar School 8	B 8.2 Insight into biodiversity of invertebrates	- arthropods and one further phylum, coelenterates, annelids or molluscs (outer and inner construction, locomotion, feeding strategies, nerve system and sensory abilities, reproduction and development, construction of colonies and communities, species diversity)
Grammar School 10	10.3 Basic interactions between living things	- relationships between living things (predator-prey relationship, symbiosis, ecological niche) - structure and characteristics of an ecosystem (biocenosis, cycle of matter, energy flow, dynamic processes) - importance and endangering of ecosystems (protection of the environment and nature, e.g., protection of species)

Structure of the content of the publication

Type of school, year level	Curriculum topic	Examples of content
Grammar School 12	12.2 Humans as a factor in the environment – population dynamics and biodiversity	- anthropogenic influences on biodiversity (e.g., by worldwide animal and plant transfer, commercial exploitation, leisure activities, input of pollutants, climate change) - importance of biodiversity (ecological and economic aspects, bioindicators) - environmental management (nature and species protection, sustainability, international treaties)
Vocational Schools	Biology	- general and applied ecology, environmental protection

Curriculum sources: Primary School, 2000; Special School, 2003; Junior High School, 2004; Secondary School (R6), 2007; Grammar School (G8), 2004, 2008; Specialised Secondary School/Vocational School, 2003.

5. Structure of the content of the publication

Twelve groups of animals including those from Bavarian fauna were chosen for the suggested activities, which are most suitable for use in school lessons and in extracurricular education. Two further chapters deal with animal tracks and long-term care of animals.

Structure of a chapter:

- Fundamental aims
- Subject information
- Literature, website addresses, contacts
- Legal information and hints
- Activities
- Additional materials to the activities

Before the start of the chapters, there is a complete overview of all the activities in the publication. Listed in the overview are animal groups, title, a brief description and level of difficulty of the individual activities, as well as recommendations for the year level and information on which season is best suited to each activity.

The overall aims are listed at the beginning of each chapter. Subject information about the respective animal group follows. The topics of biology and way of life, importance in the ecosystem, endangering and protection are addressed.

To conclude the introductory information, there is an annotated bibliography, a list of website addresses and of contacts.

Following that, there is legal information and hints on dealing with animals, especially concerning safety and hygiene.

To make carrying out activities with protected species easier, a simplified application for schools and environmental education agencies has been created, with which an exemption from conservation law can be applied for (see Appendix B).

Finally, there is a summary of the individual activities and the appendices.

Each activity is marked by recommendations as to the best time of year to carry it out and as to the school level (primary school, secondary school level 1 or 2) and also to the amount of preparation and the level of difficulty (easy, intermediate, advanced).

The respective description of the activity gives information about the aims and explains possible necessary prior subject knowledge, if this is not given at the beginning of the chapter.

Many activities have additional tasks included, which consist of materials for direct use in the field or the classroom. These additional tasks are all found at the end of each chapter.

Placement of the publication in school environmental education

The CD-ROM contains the descriptions of the activities and the additional tasks in digital form, to be used for printing out the materials. In addition to these, there is an Excel spreadsheet which records all the activities according to the criteria described above and which allows a keyword search. Furthermore, there is an extensive image database, the use of which is permitted for instructional purposes.

6. Overview about all actions

	Nr. Action	Description	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	PS	JHS	SHS	S	A	D				
Wolf and Dog	A 1	Learning about the behaviour of dogs – preventing bites	█												█	█	█	*)	█	█	█	*)		
	A 2	Experiencing wolves live in the enclosure	█												█	█	█		█	█	█			
	A 3	Wolves as a conflict-prone species	█												█	█	█		█	█	█			
Beaver	A 1	On the trail of the beaver	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 2	A role play: "My dear beaver"	█												█	█	█		█	█	█			
	A 3	The beaver as a conflict-prone species	█												█	█	█		█	█	█			
Hedgehog	A 1	Helping a young hedgehog through the winter	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 2	Explore hedgehog habitats	█												█	█	█		█	█	█			
	A 3	Hedgehog Rescue – Improving habitat structure	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 4	Telemetry of a hedgehog	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
Bats	A 1	A visit from bats in the classroom	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 2	Observation of bats on a field trip	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 3	Hunting activity of bats in various habitats	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 4	Collection of data on numbers, ecology and protection of bats	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
Birds	A 1	Experiencing birds during feeding in winter	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 2	Bird calls	█												█	█	█		█	█	█			
	A 3	Observe the development of a songbird	█												█	█	█		█	█	█			
	A 4	Hatching chicken eggs	█												█	█	█		█	█	█			
	A 5	The "thieving" magpie	█												█	█	█		█	█	█			
Amphibians	A 1	Amphibian migration	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█			
	A 2	Diversity of amphibians	█												█	█	█		█	█	█			
	A 3	Breeding tadpoles	█												█	█	█		█	█	█			
	A 4	Record the number of amphibians	█												█	█	█		█	█	█			




*) For symbol index see page XIII

Overview

	Nr. Action	Description	Month												PS JHS SHS			S A D			Image					
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	PS	JHS	SHS	S	A	D						
Grasshoppers	A 1 Diversity of grasshoppers	Knowledge in species	■														■	■	■	*)	■	■	■	*)		
	A 2 Body of a grasshopper	Examine and draw the physique	■														■	■	■		■	■	■			
	A 3 Incomplete metamorphosis of grasshoppers	Temporary raise, incomplete metamorphosis, nutrition, observe behaviour	■	■									■	■	■	■		■	■	■		■	■	■		
	A 4 Protection of grasshoppers	Suggestions for academic work in higher school levels: ecology, vulnerability and protection	■	■														■	■	■		■	■	■		
Bees	A 1 Diversity of bees and wasps	Knowledge in species, ecology of flowers	■														■	■	■		■	■	■			
	A 2 Helping bees and wasps with nesting sites	Habitat requirements, assistance and measurements					■	■	■	■	■						■	■	■		■	■	■			
	A 3 How wild bees and wasps breed	Development, lifestyle															■	■	■		■	■	■			
	A 4 Helping bees and wasps with diversity of flowers	Nectar sources, assistance															■	■	■		■	■	■			
	A 5 The honey bee as a pollinator	pollination															■	■	■		■	■	■			
	A 6 Bees live in the classroom	Bee as livestock, beekeeping															■	■	■		■	■	■			
	A 7 Visit to a beekeeper	Bee as livestock, beekeeping															■	■	■		■	■	■			
	A 8 A colony of bees in the schoolyard	Observation of the inner life of a bee colony															■	■	■		■	■	■			
Butterflies	A 1 Experience the development of a butterfly	Watch full development, temporary keeping, taking responsibility	■	■													■	■	■		■	■	■			
	A 2 Butterflies in their habitats	Knowledge of species, ecological relationships, butterfly habitats	■														■	■	■		■	■	■			
	A 3 Experiencing moths at night	Knowledge of species, ecological relationships, light as an ecological factor	■															■	■	■		■	■	■		
Animals in the water	A 1 Animals in flowing waters	Knowledge in species, morphological adaption, ecological relationships, animals as indicators	■														■	■	■		■	■	■			
	A 2 Animals in bodies of standing water	Knowledge in species, ecological relationships, animals as indicators	■														■	■	■		■	■	■			
	A 3 Water invertebrates in an aquarium	Development of insects, lifestyle	■														■	■	■		■	■	■			
	A 4 Invertebrates and structure of flowing water bodies	Ecological relationships	■														■	■	■		■	■	■			
	A 5 Invertebrates in waters as an indicator of the quality and development of those waters	Indications, evaluation, water conservation and water development, issues for project-oriented work in higher school levels	■														■	■	■		■	■	■			
Earthworms	A 1 Discovering diversity among earthworms	Knowledge in species, ecological relationships	■	■	■	■											■	■	■		■	■	■			
	A 2 Quantitatively determining earthworm density	Knowledge in species, relationships with environmental qualities	■	■	■	■											■	■	■		■	■	■			
	A 3 Body of an earthworm	Morphology of an annelid	■	■	■	■											■	■	■		■	■	■			
	A 4 Movement of an earthworm	Relationship between body constitution and locomotion	■	■	■	■											■	■	■		■	■	■			
	A 5 The senses of an earthworm	Reaction by touch, light and chemical stimuli	■	■	■	■											■	■	■		■	■	■			
	A 6 The way an earthworms eats	Nourishment and humus formation in a long-term test															■	■	■		■	■	■			
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	PS	JHS	SHS	S	A	D						

*) For symbol index see page XIII

Overview

	Nr.	Action	Description	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	PS	JHS	SHS	S	A	D		
Snails	A 1	Discovering diversity among snails	Knowledge in species	■									■	■	■	■	■	■	■	■	■	■	
	A 2	Building a snail terrarium	Temporary husbandry, habitat, assume responsibility for animals	■	■						■	■	■	■	■	■	■	■	■	■	■	■	
	A 3	Measuring, weighing and drawing snails	Examine the physique of invertebrates	■	■								■	■	■	■	■	■	■	■	■	■	
	A 4	Examining how a snail moves	Sequence of motion, speed	■	■								■	■	■	■	■	■	■	■	■	■	
	A 5	Examining snail slime	Identify the necessity of snail slime	■	■								■	■	■	■	■	■	■	■	■	■	
	A 6	Examining the senses of a snail	Reaction by touch, light and chemical stimuli	■	■								■	■	■	■	■	■	■	■	■	■	
	A 7	Observing how a snail eats		■	■								■	■	■	■	■	■	■	■	■	■	
	A 8	Diversity of snail shells	Intraspecific variation as a key principle of evolution	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Animal Tracks	A 1	Looking for tracks	Read traces, identify ecological relationships				■	■	■							■	■	■	■	■	■	■	
	A 2	Chew marks under bark	Bark beetle, development of an insect, ecological interrelationships	■								■	■	■	■	■	■	■	■	■	■	■	
	A 3	Ecological importance of the bark beetle	Suggestions for scientific studies: dealing with a conflict-prone species	■								■	■	■	■	■	■	■	■	■	■	■	
	A 4	Chew marks on hazelnuts	Read traces, identify ecological relationships		■	■	■					■	■				■	■	■	■	■	■	
	A 5	Examine pellets	Skeletons of mammals, identify the context of a prey animal's food spectrum	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Keeping animals at school	A 1	Interrelationships between environmental conditions and way of life shown by the example of reptiles	Warm-blooded and haematocryal lifestyle	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	A 2	Ecological niches of fish species in school aquariums	The principle of structure-function	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

Symbol index

Grade level:

 Primary School
  Junior High School
  Senior High School

Development:

 Simple (S)
  Average (A)
  Difficult (D)

