

Lepidoptera fauna of the German federal state of Baden-Wuerttemberg (south-western Germany) online

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Summary: The State Museum of Natural History in Karlsruhe collects data on the moths and butterflies of Baden-Wuerttemberg in a central Lepidoptera database which is not publicly accessible. The database is supervised by the Lepidoptera section of the entomological department of the museum. The observation and collection data incorporated in the database are recorded predominantly by honorary co-workers of the project. In mid 2008 we published updated distribution maps of all 1,167 Macrolepidoptera-species of Baden-Wuerttemberg online under www.schmetterlinge-bw.de. Making updated grid distribution maps available to the general public is because the maps published between 1991 and 2005 in the book series „Die Schmetterlinge Baden-Württembergs“ (The Macro-Lepidoptera of Baden-Wuerttemberg, EBERT 1991-2005) are becoming outdated slowly but inevitably. The online maps allow users to click on a grid to see the year of the record and the recorder's name which is a novel function compared with the printed maps. Observers can compare their own records with the complete set of database records and may spot potential inaccuracies or errors. Baden-Wuerttemberg is not the only place where the number of active lepidopterists is decreasing. This trend means that in the future fewer people with specialist knowledge will be available for faunistic projects. Reaching a wider range of potentially interested people via the internet may help to develop new circles of co-workers. Quality control is enhanced by the exclusive admission of dependable or checked records into the database. New recorders need to understand that a scientifically reliable record often requires documentation, beginning with photography and ending, if necessary, with the collecting of a specimen. Recorders have to be encouraged to acquire a profound knowledge of the species and to take up collecting. To this end the museum is ready to provide them assistance in applying for the necessary collecting permits. The task of the central Lepidoptera database in Baden-Wuerttemberg is to keep up-to-date our knowledge concerning the occurrence, seasonal appearance, habitats, and threats to the local species, and to make this information available to researchers, to conservationists and to the interested general public. The database contributes to the preservation of threatened Lepidoptera by providing important data to the "endangered species protection programme" (Artenschutzprogramm) of the state of Baden-Wuerttemberg which is carried out by the „Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg“ (LUBW), the federal authority for environment, measurements and nature conservation. The database is equally indispensable in supplying data on the species protected under the Natura 2000 network of the European Community (FFH), and for the production of red data books of threatened species.

Key words: central database, Baden-Wuerttemberg, faunistics, honorary co-workers, interactive distribution maps, biogeography, preservation, threatened Lepidoptera

Zusammenfassung: Das Staatliche Museum für Naturkunde Karlsruhe sammelt die Daten zu den Schmetterlingen in Baden-Württemberg in der „Landesdatenbank Schmetterlinge“ (LDS), die nicht öffentlich zugänglich ist. Sie wird im Ressort Lepidoptera der Entomologischen Abteilung betreut. Die in ihr enthaltenen Daten werden überwiegend von ehrenamtlichen Mitarbeitern gemeldet. Unter www.schmetterlinge-bw.de veröffentlicht das Museum seit Mitte 2008 aktualisierte Beobachtungskarten aller 1.167 in Baden-Württemberg heimischen Großschmetterlingsarten im Internet. Mit dem allgemeinen Zugänglichmachen von quadrantengenauen Beobachtungskarten soll dem langsamen Veralten der Verbreitungskarten im Grundlagenwerk „Die Schmetterlinge Baden-Württembergs“ (EBERT 1991-2005) begegnet werden. Die Online-Karten bieten die Möglichkeit, durch Anklicken der Nachweispunkte Melder und Jahr zu erfragen. Sie besitzen dadurch eine neue Qualität im Vergleich zu gedruckten Karten. Für die Melder geben sie Einblick in den EDV-erfassten Datenbestand des Museums. So können sie ggf. auf Fehler aufmerksam machen. Wir haben nicht nur in Baden-Württemberg das Problem, dass die Zahl der aktiven Schmetterlingsammler rückläufig ist. Daher stehen zukünftig immer weniger Menschen mit fundierten Artenkenntnissen für die Faunistik zur Verfügung. Das Erreichen potentieller Interessenten über den Internet-Auftritt kann helfen, neue Mitarbeiterkreise zu erschließen. Die ausschließliche Übernahme von verlässlichen bzw. überprüften Meldungen in die LDS soll qualifizierend wirken: Der neue Melder soll lernen, dass zur wissenschaftlich verwertbaren Meldung auch die Dokumentation des Tieres ggf. bis hin zum Sammlungsobjekt gehört. Die neuen Melder sollen so zum Erwerb von fundierten Artenkenntnissen und dem Anlegen von Belegsammlungen motiviert werden. Beim Beantragen der erforderlichen Ausnahmegenehmigungen geben wir von Seiten des Museums Hilfestellung. Aufgabe der LDS ist es, Übersicht über die einheimischen Arten hinsichtlich Vorkommen, jahreszeitlichem Auftreten, Lebensraum und Gefährdung zu behalten und diese Informationen für Naturschutz und Forschung sowie für die interessierte Öffentlichkeit bereitzustellen. Die Datenbank trägt somit zur Erhaltung gefährdeter Schmetterlingsvorkommen bei, indem sie dem Artenschutzprogramm des Landes Baden-Württemberg, das von der Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg betreut wird, wichtige Informationen liefert und ist ebenfalls unentbehrlich bei der Bereitstellung von Kenntnissen über die Arten der Fauna-Flora-Habitatrichtlinie (FFH) oder bei der Erarbeitung der Roten Listen gefährdeter Schmetterlinge.

Schlüsselwörter: Landesdatenbank Schmetterlinge, Baden-Württemberg, Faunistik, ehrenamtliche Mitarbeit, interaktive Beobachtungskarten, Verbreitung, Biogeographie, Artenschutz

Introduction and history

If we take a look at the history of the research into the Lepidoptera fauna in the federal state of Baden-Wuerttemberg, the last 200 years can be subdivided as follows; for a more detailed view see EBERT (2005): Earliest publications on the Lepidoptera fauna of our observation area appeared at the beginning of the 19th century, the first was in the year 1800 published anonymous: *Verzeichniss der Schmetterlinge, welche um den Ursprung der Donau und des Nekars, dann um den untern Theil des Bodensees vorkommen*. Its author was baron FRIEDRICH ROTH VON SCHRECKENSTEIN (1753-1808) to whom JACOB HÜBNER in 1825 has dedicated the genus *Schreckensteinia*. Furthermore in the 19th century appeared the so called “Oberamtsbeschreibungen” (descriptions of larger administrative units), which also contains short or longer lists of moths and butterflies (for instance MEMMINGER 1836 for the area of Ulm).

Between 1850 and 1900 first publications on the Lepidoptera fauna of Wuerttemberg (SEYFFER 1850) and of Baden (REUTTI 1853) appeared which were very soon followed by new editions. So for the part of Wuerttemberg by KELLER & HOFMANN (1861) and for Baden by REUTTI, SPULER & MEESS (1898). In the 20th century the consequences of the two world wars are noticeable: Publication of SCHNEIDER & WÖRZ, the next fauna of Wuerttemberg, took from 1937 to 1958. On the other hand, ALOIS GREMMINGER (1886-1959) couldn't publish his fauna of Baden any more. After his death, his exemplary card index came to the “Landessammlungen für Naturkunde” (today the State Museum of Natural History Karlsruhe).

After the 2nd World War in one very important point the situation in Baden-Wuerttemberg differs from that in other federal states: The initiation and support of the so-called “Grundlagenwerke” (basic works for the protection of species) by the Ministry of Environment in the 1980s. The outcome of this support for faunistic work was crowned by the book series „Die Schmetterlinge Baden-Württembergs“ (1991-2005) edited by GÜNTER EBERT.

The State Museum of Natural History in Karlsruhe has been collecting data on moths and butterflies of Baden-Wuerttemberg since 1967 (working group of G. EBERT) – in the past on card index sheets, since the end of the 1980s with electronical data processing (EDP). Important information sources apart from the appropriate literature are private card indexes (for instance “card index GREMMINGER”), diaries (e.g. by HERMANN LIENIG, 1888-1970), the evaluation of local collections (not all of which have been recorded until today!) and the “Mapping of important Lepidoptera biotopes in Baden-Wuerttemberg” in the years 1979-1983 as a base for the book series “Die Schmetterlinge Baden-Württembergs”. The observation- and collection-data incorporated in the database are collated mainly by honorary co-workers of the project, who

submit their information annually. This collection of data became the “Central Lepidoptera database” of today, which has been managed with the programme InsectIS¹ (SEIGER 1993-2009) since 2003.

So far, our database has not been accessible publicly. Until now the Central database has been supervised by the Lepidoptera section of the entomological department of the museum. In mid 2008 we published updated distribution maps of all 1,167 species of butterflies and moths (mainly macro-moths) of Baden-Wuerttemberg online under www.schmetterlinge-bw.de. Making updated grid distribution maps available to the general public is intended to counteract the effect that the maps published between 1991 and 2005 in the book series „The Macro-Lepidoptera of Baden-Wuerttemberg” are becoming outdated slowly but inevitably. – Not to be misunderstood here: The value of historical findings, often investigated with considerable effort, is of course beyond dispute.

In this article it is described how we keep track of changes in the Lepidoptera of Baden-Wuerttemberg with the new tool “InsectIS-Online”. Our experiences which we have gained with the application of the new technologies in the Lepidoptera-faunistics can seen as a model for the development of Lepidoptera inventories in other federal states – even if, till now, there has not hitherto been so much investigation. Before 1980, the research on the Lepidoptera fauna in our territory took a similar course as almost everywhere in Germany!

2. The Internet presence

2.1. Structure of the Internet presence The *Central Lepidoptera database* in the Internet is divided into index cards (tabs) as follows:

1. *Start page* with background information and explanations for the use of the web application,
2. *Species Observation maps*, here all species recorded in Baden-Wuerttemberg can be selected individually,
3. *Records*, for the possibility to submit single observations, and
4. *Administration* (this page is not publicly accessible).

Furthermore, there are the sub-pages *Acknowledgement*, mentioning and cross-linking our sponsors and cooperation partners, and the obligatory *Imprint*. The page *Species Observation maps* also offers thumbnails of all stages of a given species as far as available, which can be enlarged by clicking on them.

¹ InsectIS is built on MS Access and includes standardized species lists of many Insect orders, habitat catalogues, plant lists, ‘Red data lists’ etc. Its geographic information system is called PIApro© and is manufactured by the Company Forstware (Meersburg, Southwest-Germany). InsectIS has a more than 15-years programming-history and is meanwhile used in many places in Germany for the collection of faunistic-data of insects.

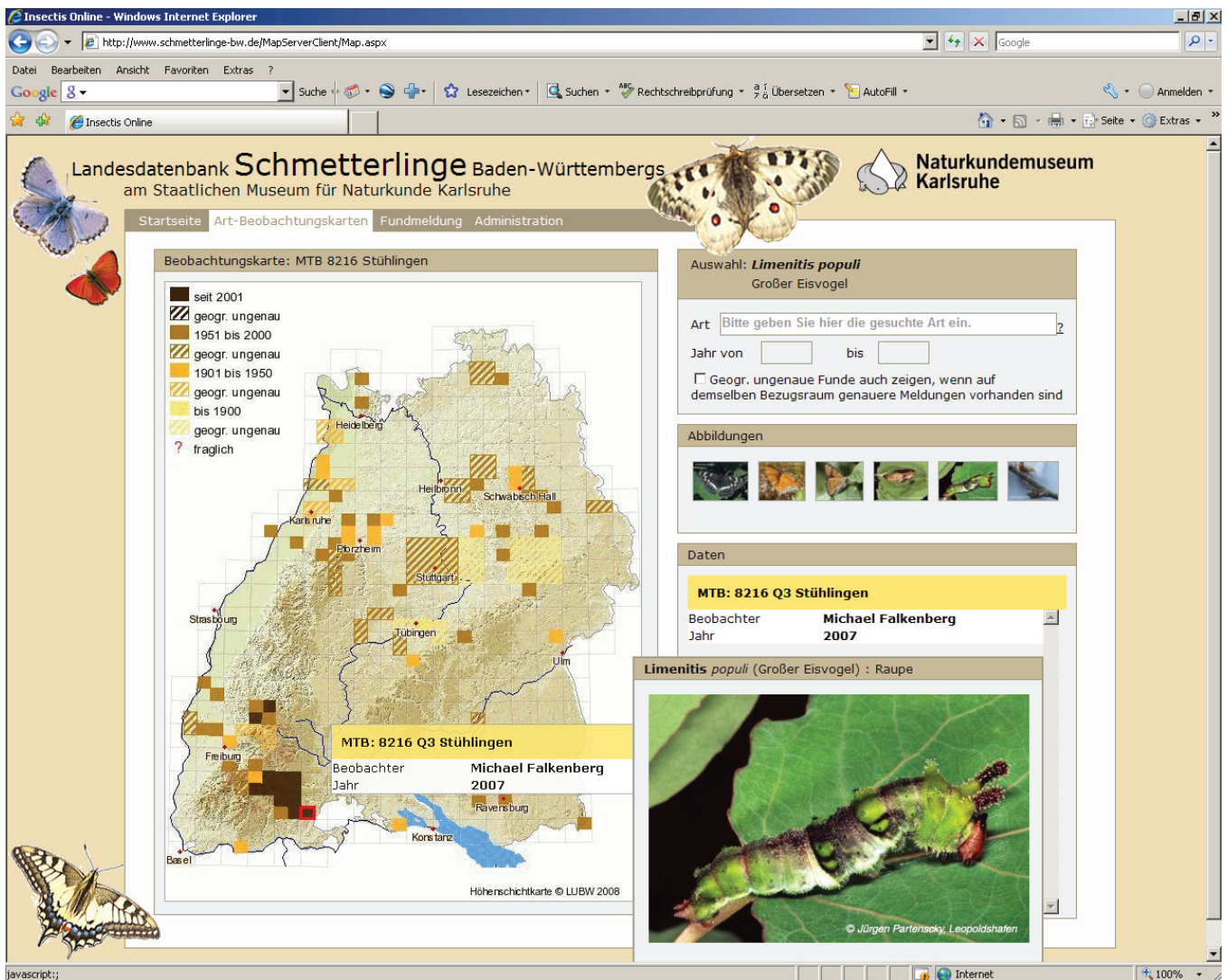


Fig. 1. Screenshot of the distribution map of *Limenitis populi* (LINNAEUS, 1758) from the “Central Lepidoptera Database Baden-Wuerttemberg” (www.schmetterlinge-bw.de). Positioning the mouse on a square with a record shows the three most recent records from this square (in the figure only one record is available). The caterpillar of the species has been selected too.

Approximately 6,000 photographs are needed for the illustration of all Macro-Lepidoptera (egg, 1-2 larvae, pupae, and 1-2 imago; preferably upper- and underside or male/female in species with dimorphic phenotypes).

2.2. How to access a grid distribution map? For a species you are interested in, type in the first letters of the scientific name (after KARSHOLT & RAZOWSKI 1996) or German vernacular name (after “The Macro-Lepidoptera of Baden-Wuerttemberg”), e.g.: **E**isvogel, **G**roßer oder **L**imenitis **p**opuli (LINNAEUS, 1758). With the first letters appears a choice list which becomes shorter as letters are added. Often a few letters are sufficient, which can also be taken from the middle of the name. (Even to type in the species-epithet first is possible). In our example, the first four letters are enough to have a list of only the three local *Limenitis*-species amongst which one can choose. In this way a comfortable and at the same time quick work with the webpage is guaranteed. – There is only one pre-

requisite: One has to know what one is looking for! It is our intention to address a user community which has knowledge of Lepidoptera species.

2.3. Result of a query A relief map of Baden-Wuerttemberg with the official ordnance survey map grid is shown (this is the grid of our official topographical maps; scale 1:25,000) on which the corresponding records are applied on the area of a so called “MTB quadrant” (that is a quarter of the map, on the ground approx. 6 x 6 km). Four time periods are distinguished by colours. The legend you can find in the upper left edge of the map. The meanings are: pale yellow “till 1900”, orange “1901-1950”, olive-green brown “1951-2000”, and deep brown “since 2001”. The more intensive (the impression) of the colour, the more recent is the record.

Records which cannot be placed precisely are shown hatched on a larger area. For each map square the user can see details of the records: the year of observation and the name of the recorder, as the usual

standard in scientific literature (author, year). He only must point with the mouse at the MTB quadrant of the screen he is interested in, and the three most current records are shown. If there are more than three records, the complete list of records will appear after selecting a given quadrant down on the right, below of the point "data" ("Daten"). In our example *Limenitis populi* you can see very well that this species once occurred nearly all over the country. Today it is almost entirely restricted to the southern Black Forest.

3. Advantages of the internet

The internet offers a crucial advantage: Instead of a printed distribution map in a book or journal, which becomes outdated over the years, there is the updatable observation map. In comparison, the online maps hold a new quality: The recorder within the country can draw one's attention to errors in the data pool, missing records, input mistakes, etc. These mistakes can be corrected and are not caught for all times between two book covers.

Whilst programming and designing the web page it was important for us to make handling as intuitive as possible. This way, users can quickly and uncomplicatedly inform themselves about the current Lepidoptera records inside the data-pool of our museum. The desire of the faunist to compare an interesting record of his own with the museum data pool is very big – especially if he has just found something special! This legitimate need is taken into account with our web application. Our database will be updated at least once every year. Improved technology will allow us in the foreseeable future to carry out these updates more frequently. So, every recorder can see "his" and of course also all other records at least for the last year. In comparison, printed faunas are often many years old. – Furthermore, the obvious lack of records in certain grid field squares draws one's attention to insufficiently investigated areas. These gaps in our knowledge can be closed more specifically in future as this was practical before.

The number of the active Lepidoptera collectors is declining – we have this problem not only in Baden-Wuerttemberg. Consequently in future less and less people who have sound knowledge about the species will be available for the observation of the fauna. To touch potentially interested persons over the internet can help develop new circles of recorders.

It has already been shown that this works: 52 recorders joined in the first half year of which only seven had contact with our working group before.

4. How will data be transmitted?

All recorders are asked to enter their observations into the program InsectIS which is available free of charge in the internet (www.insectis.de). According to

our experience data-capture mistakes are minimised if the observers enter their data themselves. In addition, a better geographical positioning of the localities is achieved. Formerly, accuracy of locality data was sometimes suboptimal because precise information was absent or the necessary knowledge of the localities was not available to the museum staff in Karlsruhe.

All InsectIS data can be exported and transmitted to the central database on disk or by e-mail. Of course, traditional lists on paper or observations sent by e-mail are also accepted. However, the data entry of these records takes time. At the moment a direct „Online input“ into the data base is not planned yet, in order to have as little error potential as possible inside the main data pool. However, there is the possibility to inform us about single observations directly via the web page. This is interesting in particular for observers with single records.

5. Plausibility check of the records

Only records which are generated by experts or records which are scientifically verifiable have a permanent place inside our Central Lepidoptera database. The exclusive incorporation of reliable or checked data is intended to have a qualifying effect: A new recorder should learn that a scientifically useful record includes the documentation of the specimen in suitable form, especially in species which are difficult to identify or species which could be doubted, for instance records of Red List species. The documentation can be a good photograph which shows the relevant identification characters, but the collection of specimens is sometimes necessary. New co-workers should be motivated to obtain good knowledge about species and to start collecting themselves. When applying for the required permissions the museum staff supports honorary co-workers.

6. What does faunistic research serve for?

The *Central database Lepidoptera* is necessary:

1. to document changes in the lepidoptera fauna, and
2. to broaden the knowledge about the species stock and the species composition, especially in still insufficiently investigated areas of Baden-Wuerttemberg.

All local Lepidoptera species shall be observed with respect to occurrence (i.e. regression and expansion, invasive species, possible pests); seasonal appearance (indicators for climate change); habitat, and threats. This information is provided as a basis for conservation authorities, for researchers as well as for the interested public. In this way faunistic research

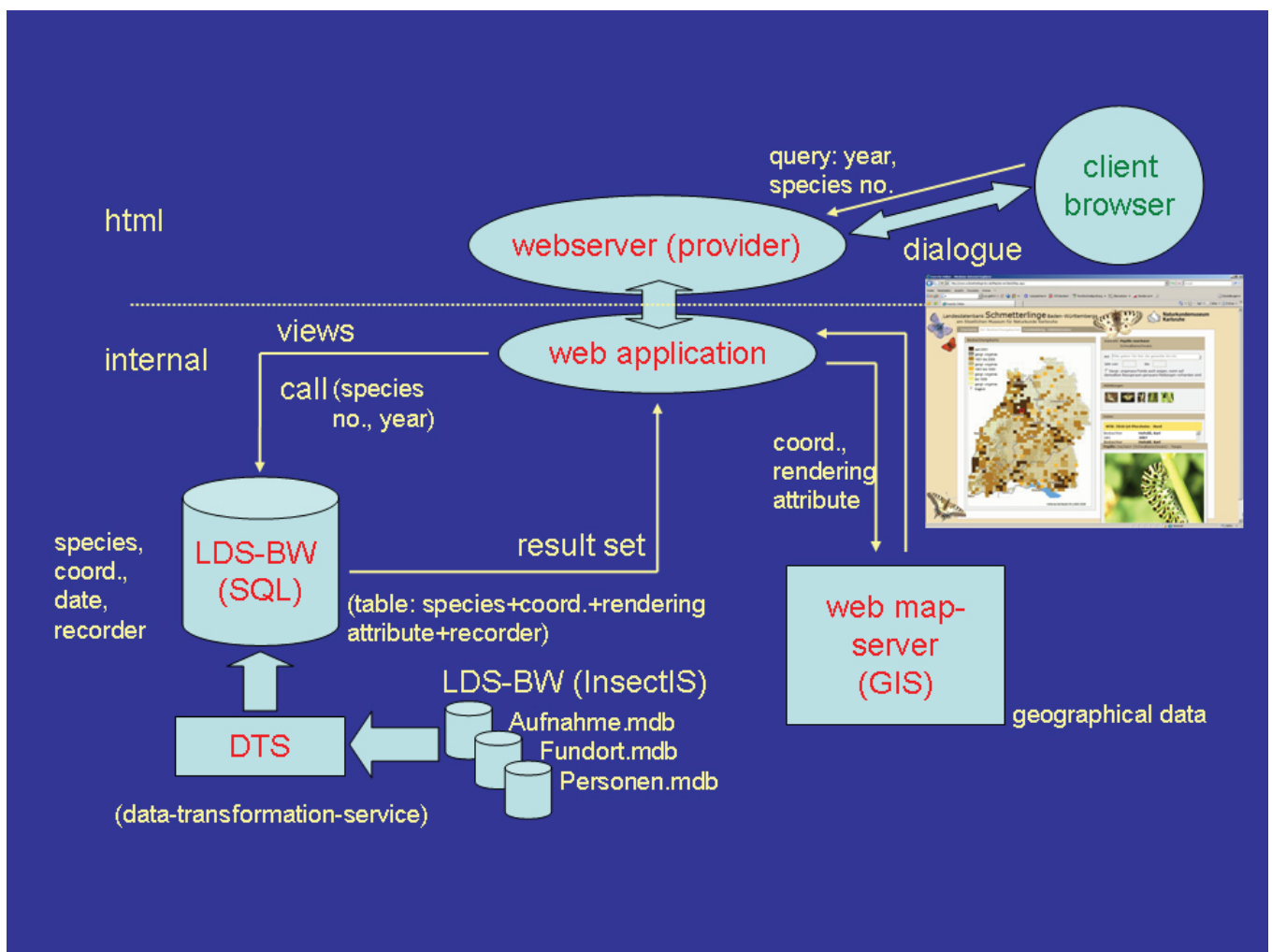


Fig. 2. Organization chart of the “Central Lepidoptera Database Baden-Wuerttemberg” online (www.schmetterlinge-bw.de).

contributes to the preservation of threatened Lepidoptera by providing important data to the “endangered species protection programme” (“Artenschutzprogramm”) of the state of Baden-Wuerttemberg which is carried out by the “Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg” (LUBW), the “federal authority for environment, measurements and nature conservation”. The database is equally indispensable in supplying data on the species protected under the Natura 2000 network of the European Community (FFH), and for the production of red data books of threatened species.

7. Perspective

“Everyone is talking – about Biodiversity, the faunists investigate it”, is a quotation of KLAUSNITZER (2007) in a lecture with the title “Faunistics as a future science”. A survey of the Lepidoptera of the whole of Germany, a *Lepidoptera fauna of Germany* would be desirable. If further federal states with a good stock of faunistic data followed with the tool *InsectIS online* introduced here, then gradually this overview about the German fauna would be possible – this might be a desire of all German Lepidopterists.

Of course, the history of the Lepidoptera faunistics in every federal state of Germany has local peculiarities, which necessitates customizations. At present, the database can not be provided by an institute everywhere. However, in my opinion these disadvantages aren’t so strong that they couldn’t be overcome. The web application *InsectIS-Online* is offered here to all interested persons free of charge. Apart from the advantages shown here, there is no need to hand over one’s database to a third person. The operator only uploads those data which are later visible in the internet – not more. One only needs:

1. One person in charge, who collects all data from his federal state within the program *InsectIS* (with this program the upload is possible by pressing a button),
2. adaptation of the topography for each state (costs approx. € 1,000,-),
3. costs of the internet server provider (costs approx. € 500,- per year)

All photographs illustrating the species already existing on our website could be used, to avoid repeating this immense work again and again.

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