# MausDB

## Installation Guide

## And

## User Manual

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# 1 Introduction

## 1.1 Definition, purpose and intended use

**What is MausDB?**

MausDB is a laboratory mouse information and management system (LMIMS). MausDB has been custom developed for the needs and requirements of the German Mouse Clinic (GMC)[2].

It has been published[3] and made freely available for the scientific community.

Its purpose is to facilitate all aspects of handling laboratory mice

- by storing all relevant data of a mouse facility including animal data in one central database.
- by providing this data to all users simultaneously on a multi-user access platform.
- by ensuring that information is up-to-date and all users have access to the same information (in contrast to working with distributed spreadsheet files).
- by providing useful overviews and search functions

Its intended use is to comprehensively manage mouse houses ranging from one rack only up to large mouse facilites hosting tens of thousands of mice.

## 1.2 Technical information

MausDB is a web-based CGI application built on Linux, Apache, MySQL and Perl (LAMP).

As MausDB works with database transactions, it makes use of the InnoDB storage engine provided by MySQL. MausDB should also work with any other transactional storage engine or transactional database management system (e.g. PostgreSQL) in principle. Though this has not been tested at all, it might be neccessary to adapt SQL statements in order to fully comply with SQL standards or RDBMS-specific “SQL dialects”.

In order to avoid dependency from a single database management system, the whole business logic has been implemented on application level rather than on database level, i.e. stored procedures.

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[3] Maier, H., Lengger, C., Simic, B., Fuchs, H., Gailus-Durner, V., Hrabé de Angelis, M. **MausDB: an open source application for phenotype data and mouse colony management in large-scale mouse phenotyping projects.** *BMC Bioinformatics* 2008, **9**:169

## 1.3 MausDB features

MausDB covers most aspects of handling laboratory mice for scientific purposes, including:

- importing mice from external sources
- mouse breeding
    - mating
    - embryo transfer
- weaning
- moving mice (cage and/or rack transfers)
- cage card printing
- locating mice, full rack and cage overview
- collecting and grouping mice in so-called “carts” or cohorts (for statistical purposes)
- genotyping mice (multiple genotypes possible)
- culling mice
- manage experiment licenses
- manage cost center assignment (multiple cost centers possible)
- breeding statistics (per line): sex ratio, litter per mother, average litter size, …
- mouse phenotyping
    - definition of structured phenotyping workflows
    - definition of phenotyping parameters
    - definition of phenotyping parameter sets (parameters from one assay)
    - schedule phenotyping tasks for single mice or groups of mice on a weekly basis
    - query and manage status of phenotyping tasks
    - upload phenotyping results to database from spreadsheet files
    - extract and export phenotyping results from database to spreadsheet format
    - statistical analysis and visualisation of phenotype data using pre-defined R[4] scripts via the MausDB web interface
- export mouse breeding data to spreadsheet files
- uploading and attaching custom files to single mice or groups of mice, e.g. image files or spreadsheet files

[4] http://www.r-project.org

## 1.4 License

MausDB has been made available under the terms of the GNU General Public License (GPL). See http://www.gnu.org/licenses/gpl.html for more details.



## 1.5 Before using MausDB …

Carefully read the GNU General Public Licence (see above) under which MausDB has been made available before using MausDB. Please pay particular attention to what the license says about warranty, liability and risk of use.

# 2 Installation

## 2.1 Before you start …

This installation guide is based on the use of Ubuntu Linux, version 8.04 LTS, server edition.

It is possible to install MausDB on other systems as well (succesfully tested with Mac OS X). Package installation procedures, pathes and settings may vary and must be adapted when installing MausDB on other systems.

**Time required**

Following this installation guide, a fully functional MausDB server can be installed on any machine from scratch within 60 - 90 minutes. This includes a complete installation of Ubuntu Linux, installation and setup of MausDB and restoring an initial database.

**Conventions**

In the following instructions, two conventions apply:

\\ indicates that a command needs to be continued on the same line

<> indicates a variable, for example a user-defined password

## 2.2 Setting up a Linux system as MausDB server

### 2.2.1 Standard installation of Ubuntu Linux 8.04 LTS, server edition, from CD

The server version of Ubuntu is recommended. Installation CD ISO-images can be downloaded from http://www.ubuntu.com. Other Ubuntu versions will most probably work as well but may require slight modifications as package names may be different.

It is recommended to set up a user „***admin***“. This user must belong to the group ***admin***, which is neccessary to obtain root privileges using ***sudo***. When using the ***sudo*** command, you will be asked for a password. Please provide the password of ***admin*** here.

When asked for the local time, you may enter “automatic” and enter a time server address.

When using a multiple hard disk system, we recommend the following setup:

| disk/device | mountpoint | description |
|---|---|---|
| /dev/sda1 | / | operating system |
| /dev/sdb1 | /var | mysql database separated from operating system |

After finishing the Ubuntu standard installation, **networking must work**, unless the following steps cannot be accomplished.

This installation guide assumes that the following steps are done as user ***admin***.

### 2.2.2 X server

The MausDB R interface requires X to be installed. Either choose X to be installed on your system at the very beginning [e.g. by installing a desktop version] or install the package "kubuntu-desktop" (which is quite an excess but will make sure X is running and set up properly). If you choose a desktop ubuntu version that comes with the default Gnome Desktop, this will do fine and you can skip the next step.

**[optional: install kubuntu-desktop]**

```
# sudo apt-get install kubuntu-desktop
```

### 2.2.3 ssh installation

**install the open-ssh server and client**

```
# sudo apt-get install ssh
```

**[if neccessary, restart the ssh daemon]**

```
# sudo /etc/init.d/ssh restart
```

After finishing this step, login to the computer must be possible via ssh from a remote machine.

### 2.2.4 Short introduction to apt

Ubuntu Linux makes use of the package management system ***apt*** to install and manage software packages. A package index is maintained on the local machine. Using this index, the system „knows" which packages are installed. Prerequisites and dependencies between packages are known and ***apt*** resolves these dependencies or tells you about problems.

Local package index files are synchronised via the internet with so called repositories or sources. In ***/etc/apt/sources***, it can be defined, which sources have to be used. By including formerly commented sources, the system can be expanded by other packages.

**Search in the package repository**

```
# apt-cache search <searchterm>
```

**Get details about a package**

```
# apt-cache show <packagename>
```

**Update the package index**

```
# sudo apt-get update
```

**Upgrade the system (will install up-to-date packages)**

```
# sudo apt-get upgrade
```

### 2.2.5 [maybe required: de-activate the installations CD as a package source]

In order to get the latest updates from the remote Ubuntu/debian repositories, ***/etc/apt/sources.list*** must be changed.

```
# sudo nano /etc/apt/sources.list
```

comment out the line starting with: `deb cdrom: ...`

### 2.2.6 [may be required: Including the „universe“ package sources]

Some packages are only available using the „universe“ package sources.

```
# sudo nano /etc/apt/sources.list
```

un-comment (activate) the line starting with: `deb ... universe` and `deb-src ... universe`

### 2.2.7 Update the package tree

The package index file (package tree) must be updated in order to set up a system, which is as safe as possible.

```
# sudo apt-get update
```

### 2.2.8 Update the system

All packages that can be updated, will be updated by typing:

```
# sudo apt-get upgrade
```

### 2.2.9 Installation of apache

Install the apache web server by typing:

```
# sudo apt-get install apache2
```

### 2.2.10 Installation of mysql

Install the mysql server by typing:

```
# sudo apt-get install mysql-server
```

You may be asked to give a password for the mysql root user during installation. Please be aware that the mysql root account is different from the system root account.

### 2.2.11 Installation of mailx and postfix

Install the mail system by typing:

```
# sudo apt-get install mailx
```

```
Choose “Internet Site” in the following postfix configuration
dialog.
```

### 2.2.12 Installation of ntpdate

Install the ntpdate client to synchronize system time to time servers:

```
# sudo apt-get install ntpdate
```

### 2.2.13 [maybe required: set a password for the Mysql root user]

There is a mysql admin user named *root,* which is comparable to the user *sa* in other DBMSs.

**Attention**: mysql *root* is different from the linux *root* user!

**Set the password for mysql root (may be skipped if root password has been set at mysql installation):**

```
# sudo mysqladmin -u root password <new-password>
```

`<new-password>` is to be replaced by the new password.

### 2.2.14 Install some packages neccessary for CPAN

In order to be able to install Perl modules via CPAN, some additional packages must be installed by typing:

```
# sudo apt-get install ncftp
# sudo apt-get install lynx
# sudo apt-get install unzip
# sudo apt-get install make
# sudo apt-get install gcc
```

### 2.2.15 [optional: Create a directory for the mysql binary logs]

Ideally, the binary logs directory should be on a separate hard disk and for this reason independent from the one which hosts the database. **You also can leave everything on default and skip this step.**

If mountpoint / is separated from mountpoint /var:

- **create a directory for the binary logs, e.g. “/mysql_binlogs”**

- **set correct rights for this directory**

```
# sudo chown mysql:adm /mysql_binlogs
```

### 2.2.16 [optional: Configure MySQL]

Configuration of mysql is done in the file ***/etc/mysql/my.cnf***

Before making changes to the configuration, stop mysql:

```
# sudo /etc/init.d/mysql stop
```

**Attention**: **adapt the entry *server-id*. Every server needs its own ID!**

**Change to /etc/mysql**

```
# cd /etc/mysql
```

**Make a backup copy of the config file**

```
# sudo cp my.cnf my.cnf.old
```

**Edit *./etc/mysql/my.cnf***

```
# sudo nano /etc/mysql/my.cnf
```

**Add or change the following lines:**

```
[client]
default-character-set=utf8              (add[5])

[mysqld]
character-set-server=utf8               (add[5])
default-collation=utf8_unicode_ci       (add[5])
init-connect='SET NAMES utf8'           (add[5])

server-id = 1                           (possibly change)
log-bin = /mysql_binlogs/mysql-bin.log  (possibly change)
binlog-do-db = mausdb                   (possibly change)
binlog-ignore-db  = mausdb_demo         (possibly change)
```

Choose binary logging for every MausDB database (but not the blob databases).
After making changes to the configuration, you need to restart mysql:

```
# sudo /etc/init.d/mysql start
```

[5] if you don't have to deal with special characters (Umlaut, accents, …) you may skip this

### 2.2.17 Configure CPAN

Using CPAN, Perl modules can be easily downloaded and installed from the CPAN repository or its mirrors. Prerequisites and dependencies are resolved automatically.

**Short introduction to CPAN**

**Start CPAN**

```
# sudo cpan
```

**or**

```
# sudo perl –MCPAN –e shell
```

**Initial configuration**

When starting CPAN for the first time, you need to answer some questions, which are self-explanatory. If cpan is slow, try using passive ftp:

# sudo env FTP_PASSIVE=1 cpan –i Net::FTP

**Attention**:
When asked for "Policy on building prerequisites (follow, ask or ignore) [ask]", answer "follow"

**Installing Perl modules using CPAN**

```
cpan> install Date::Calc
```

### 2.2.18 Installation of additional packages and Perl modules

If installation via CPAN fails, pre-compiled modules can be installed from the Ubuntu package repository:

[Example: `# sudo apt-get install libdate-calc-perl`]

**The following packages are neccessary in order to run MausDB**

**via apt**

`perl-GD (pre-compiled Perl-GD-Modul)`

```
# sudo apt-get install libgd-gd2-perl
```

`libgd-devel`

```
# sudo apt-get install libgd2-xpm-dev
```

smbfs

```
# sudo apt-get install smbfs
```

DBI with DBD::mysql

```
# sudo apt-get install libdbd-mysql-perl
```

CGI.pm

```
# sudo apt-get install libcgi-perl
[#sudo apt-get install libcgi-pm-perl if above fails]
```

CGI::Session

```
# sudo apt-get install libcgi-session-perl
```

Date::Calc

```
# sudo apt-get install libdate-calc-perl
```

Digest::MD5

```
# sudo apt-get install libmd5-perl
```

Mail::Sendmail

```
# sudo apt-get install libmail-sendmail-perl
```

DBD::Excel

```
# sudo apt-get install libdbd-excel-perl
```

**via CPAN**

GD::Barcode

```
# sudo env FTP_PASSIVE=1 cpan
cpan> install GD::Barcode
```

Spreadsheet::WriteExcel::Simple

```
# sudo env FTP_PASSIVE=1 cpan
cpan> install Spreadsheet::WriteExcel::Simple
```

Spreadsheet::ParseExcel

```
# sudo env FTP_PASSIVE=1 cpan
cpan> install Spreadsheet::ParseExcel::Simple
```

Array::Transpose

```
# sudo env FTP_PASSIVE=1 cpan
cpan> install Array::Transpose

[remark: this may require installation of modules Test::Pod and
Test::Pod::Coverage]
```

### 2.2.19 Installation of packages required for statistics and visualisation

**Install R**

```
# sudo apt-get install r-base
```

**Install additional CRAN modules via apt**

```
# sudo apt-get install r-cran-tseries
# sudo apt-get install r-cran-lattice
# sudo apt-get install r-cran-dbi
# sudo apt-get install r-cran-rmysql
# sudo apt-get install r-cran-gdata
# sudo apt-get install r-cran-gmodels
# sudo apt-get install r-cran-gplots
# sudo apt-get install r-cran-gregmisc
```

### 2.2.20 Install xvfb (Virtual Framebuffer 'fake' X server)

```
# sudo apt-get install xvfb
```

[may be required: add path to xvfb to xvfb-run]

```
# sudo nano /usr/bin/xvfb-run
```

Look for line PATH=…, add /bin to the path. It should read:

```
PATH=$PATH:/usr/bin/X11:/usr/X11R6/bin:/bin
```

#### 2.2.21 Synchronize the system time to a time server

[remark: the following step can be skipped if synchronization to a time server has been choosen during installation of Ubuntu].

Set up a cron job to run ntpdate

```
# sudo crontab –e
```

**Enter the following line:**

```
0 2 * * * /usr/sbin/ntpdate <time_server>
```

#### 2.2.22 Switch off log-flushing by the Ubuntu log-rotate service

By default, mysql binary logs are flushed once a day. This is done by the log-rotate service. Binary log files that are generated this way are not copied to a safe place by the backup script. Comment out everything in **/etc/logrotate.d/mysql-server** to stop this service.

## 2.3 Installation of MausDB

### 2.3.1 Download MausDB installation files

Download MausDB_vx.x.tar.gz from http://jupiter.helmholtz-muenchen.de

Extract downloaded file into /home/admin/mausdb:

```
# tar –xvzf MausDB_vx.x.tar.gz
```

Please make sure that that the resulting directory structure looks like this (the following instructions are based on this structure). It may be necessary to rename the directory:

```
# mv mausdb_v1.5 mausdb
```

```
/home/admin/mausdb/SQL
/home/admin/mausdb/SQL/check_consistency
/home/admin/mausdb/SQL/delete
/home/admin/mausdb/SQL/insert
/home/admin/mausdb/SQL/setup_database
/home/admin/mausdb/SQL/select
/home/admin/mausdb/SQL/update
/home/admin/mausdb/code
/home/admin/mausdb/code/var
/home/admin/mausdb/code/var/maus_connect
/home/admin/mausdb/code/var/www
/home/admin/mausdb/code/var/www/mausdb
/home/admin/mausdb/code/var/www/mausdb/css
/home/admin/mausdb/code/var/www/mausdb/images
/home/admin/mausdb/code/var/www/mausdb/maustmp
/home/admin/mausdb/code/var/www/mausdb/static_content
/home/admin/mausdb/code/var/www/mausdb/static_pages
/home/admin/mausdb/code/var/www/mausdb/R
/home/admin/mausdb/code/var/www/mausdb/R/output
/home/admin/mausdb/code/usr
/home/admin/mausdb/code/usr/lib
/home/admin/mausdb/code/usr/lib/cgi-bin
/home/admin/mausdb/code/usr/lib/cgi-bin/mausdb
/home/admin/mausdb/code/usr/lib/cgi-bin/mausdb/files
/home/admin/mausdb/code/usr/lib/cgi-bin/mausdb/logs
/home/admin/mausdb/code/usr/lib/cgi-bin/mausdb/sessions
/home/admin/mausdb/code/usr/lib/cgi-bin/mausdb/uploads
/home/admin/mausdb/info
/home/admin/mausdb/services
```

### 2.3.2 Settings based on a typical Ubuntu installation

Assumption made for the following steps:

| | |
|---|---|
| apache htdocs folder is located at: | */var/www/* |
| apache cgi folder is located at: | */usr/lib/cgi-bin* |
| connection parameters: | */var/maus_connect* |
| apache system user: | ‘www-data’ (group ‘www-data’) |

### 2.3.3 Install the MausDB script files

**Copy the directories and files from the above directories to their target directories (/var, /var/www, /usr/lib/cgi-bin) and set ownerships to www-data:www-data**

```
# cd /var
# sudo cp –R /home/admin/mausdb/code/var/* .

# cd /var/www
# sudo cp –R /home/admin/mausdb/code/var/www/* .
# sudo chown –R www-data:www-data mausdb*

# cd /usr/lib/cgi-bin
# sudo cp –R /home/admin/mausdb/code/usr/lib/cgi-bin/* .
# sudo chown –R www-data:www-data mausdb*
```

### 2.3.4 Configuration of MausDB

**adapt connection parameters in /var/maus_connect/DB_connect.pm**

```
# sudo nano /var/maus_connect/DB_connect.pm

enter suitable settings (username & password)
```

**adapt MausDB config files**

```
# sudo nano /usr/lib/cgi-bin/mausdb/config.rc

enter suitable settings
```

### 2.3.5 Create the directories for the backup system

Some directories must be created for the backup system:

```
# cd /home/admin
# mkdir /home/admin/backup
# mkdir /home/admin/backup/daten
# mkdir /home/admin/backup/daten/<yourfacility>
# mkdir /home/admin/backup/logs
# mkdir /home/admin/backup/logs/<yourfacility>
```

### 2.3.6 Installation of the backup script

**copy backup script and set appropriate ownerships**

```
# cd /home/admin/backup
# cp /home/admin/mausdb/services/backup.pl .
# cd ..
# sudo chown –R admin:admin backup
```

**adapt settings in backup.pl according to your system and paths**

```
# sudo nano backup/backup.pl
```

Although this should be rather self-explanatory, some help and explanation:

All settings are stored in a 2-dimensional global hash named **%backup_data**. The first, numeric key describes the database to be backed up, the second, text key describes the specific setting for this database.

**Sections**:

```
$backup_data{0}{...}    global settings for all databases
$backup_data{1}{...}    settings for first database
$backup_data{2}{...}    settings for second database
....
```

Below this settings block, there are some if (...) entries. In order to include a database into the backup script, you need to generate a settings block and suitable if (...) entry.

**setup cron job to run backup.pl automatically**

```
# sudo crontab –e
```

**Enter the following lines** (\\ means: into same line)

```
0 23 * * * /usr/bin/perl /home/admin/backup/backup.pl \\ do_backup=yes >>
/home/admin/backup/backup.log
0 8-18 * * 1-5 /usr/bin/perl /home/admin/backup/backup.pl \\
flush_bin_logs=yes >> /home/admin/backup/backup.log

will run a full dump at 23:00 every night
will flush binary logs every hour at 8:00-18:00 at monday-friday
```

### 2.3.7 Installation of the checkup script for daily control of database integrity

**copy checkup script and set appropriate ownerships**

```
# cd /home/admin/backup
# cp /home/admin/mausdb/services/checkup.pl .
# cd ..
# sudo chown –R admin:admin backup

adapt settings in backup.pl according to your system and paths (see above):

# sudo nano backup/checkup.pl

In order to setup cron job to run checkup.pl automatically proceed as
described above for backup script.
```

**At this point, all software needed to run MausDB should be installed and configured on your system. The following steps describe how to set up a MausDB installation.**

# 3 Setting up a new mouse facility (for admin users)

## *3.1 Restoring from a backup dump file*

In case you had MausDB already running and need to restore the database from a dump file on a different server:

```
# mysql –u <username> –p<password> mausdb < dumpfile.sql
```

If all your data is contained in dumpfile.sql – that's it.

## *3.2 Starting from scratch*

In case you install MausDB for the first time, the following steps describe how to do that.

### 3.2.1 Create the MySQL databases

**login to mysql as mysql-root (remember: this is not the same root as system root)**

```
# mysql –u root –p<password>
```

Attention: no whitespace between –p and the password!

**create database mausdb and blob-database**

```
mysql> create database mausdb;
mysql> create database mausdb_blobs;
```

**create database user for MausDB** `(\\ means: into same line)`

```
mysql> grant all on mausdb.* to '<user>'@'localhost'            \\
       identified by '<password>';
mysql> grant all on mausdb_blobs.* to '<user>'@'localhost'      \\
       identified by '<password>';
```

**update privileges table**

```
mysql> flush privileges;
```

quit the mysql command mode

```
mysql> quit
```

### 3.2.2 Creating database tables and functions using DDL scripts

```
Create tables by running create table DDL script (\\ means: into same
line):
```

**Create main MausDB tables**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/create_tables_mausdb.sql
```

**Create MausDB blob database table**

```
# mysql –u <user> –p<password> mausdb_blobs <     \\
/home/admin/mausdb/SQL/setup_database/create_tables_mausdb_blobs.sql
```

**Some user-defined functions**

```
# mysql –u <user> –p<password> mausdb       <     \\
/home/admin/mausdb/SQL/setup_database/mr2string.sql

# mysql –u <user> –p<password> mausdb       <     \\
/home/admin/mausdb/SQL/setup_database/get_number_of_cagemates.sql

# mysql –u <user> –p<password> mausdb       <     \\
/home/admin/mausdb/SQL/setup_database/get_simple_value_for_mouse_p_ps.sql

# mysql –u <user> –p<password> mausdb       <     \\
/home/admin/mausdb/SQL/setup_database/mice-genotypes.sql
```

Now all tables are defined - but empty. Some initial values need to be in the database in order to start. This is described in the following steps.

### 3.2.3 Load initial settings into database

Some initial and essential settings are set in the following steps by loading pre-filled tables into the database. (\\ means: into same line)

**Master data for days**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/days.sql
```

**Master data for settings**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/settings.sql
```

**Master data for death_reasons**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/death_reasons.sql
```

**initial admin user account (username: admin, password: mausdb)**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/initial_admin_account.sql
```

**initial mylocks**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/mylocks.sql
```

**[optional: examples for phenotype and routine task workflow management and worklist scheduling]**

```
# mysql –u <user> –p<password> mausdb <          \\
/home/admin/mausdb/SQL/setup_database/parametersets.sql
```

## 3.3 Logging in to MausDB as „admin“

Assuming you installed MausDB on a computer named „mausdbwww“ following the instructions given in this manual, you should be able to log in to the inital system.

Just use Mozilla Firefox to access the following URL:

http://mausdbwww.yourdomain/cgi-bin/mausdb/mausdb.cgi

Enter **„admin“ as username and „mausdb“ as password** (these have been defined in the previous step, see above). Don’t forget to change the password as soon as possible.

## 3.4 Defining your mouse facility

In this step, all settings that are specific to your mouse facility need to be defined.

### 3.4.1 Defining rooms and racks (admin function)

As MausDB manages all rooms, racks and cages of your mouse facility, the racks must be defined beforehand. As admin, choose ***settings → new rack.***

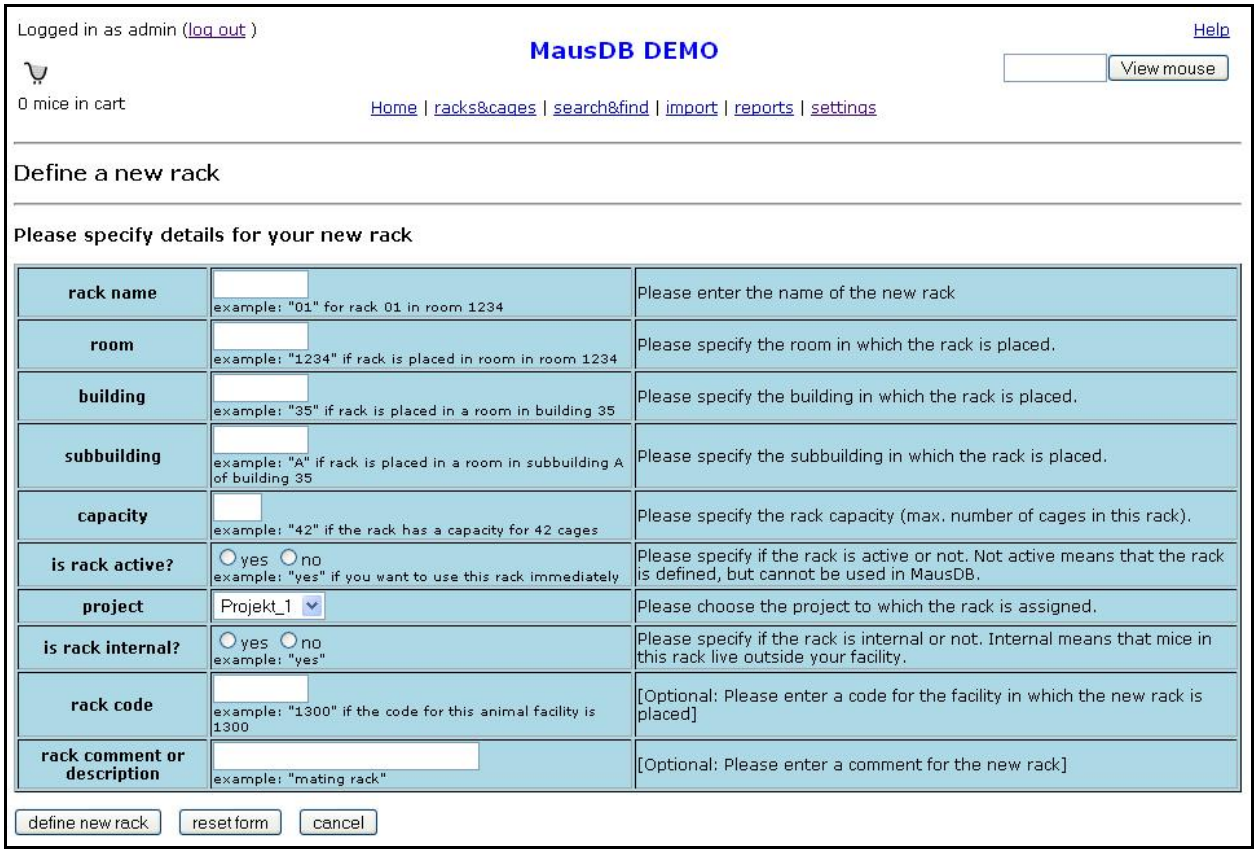



**Figure 1: Defining a new rack by entering rack specific information. Please take care that the total number of cages corresponds to the total rack capacity.**

### 3.4.2 Defining cages (admin function)

As MausDB manages all rooms, racks and cages of your mouse facility, the cages (the cage pool) must be defined beforehand. MausDB does not manage individual physical cages but a pool of cages that are tagged with a cage id. Therefore, it is required that the number of cages defined (i.e. the size of the cage pool) corresponds to the total capacity of all racks defined. As admin, choose ***settings → new cages.***

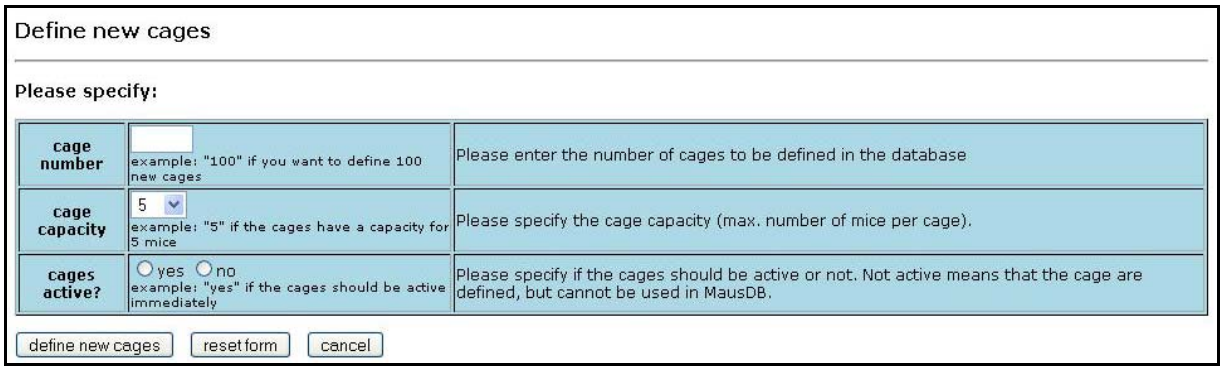



**Figure 2: Defining new cages. Please take care that the total number of cages corresponds to the total rack capacity.**

### 3.4.3 Defining projects (admin function)

MausDB uses projects in two ways. Every user is assigned to one ore more projects. Every rack and every mating is assigned to exactly one project. In this context, project affiliation determines the view on racks and matings a user gets after logging in. Per default, a filter is set so that only those racks are shown that belong to user's projects. At any time, every user can decide to view all other racks too. The same is true for matings.

Phenotype results are strictly managed by projects. They are only presented to the user if they belong to a user's project or if they are public.

As admin, choose ***settings → new project.***

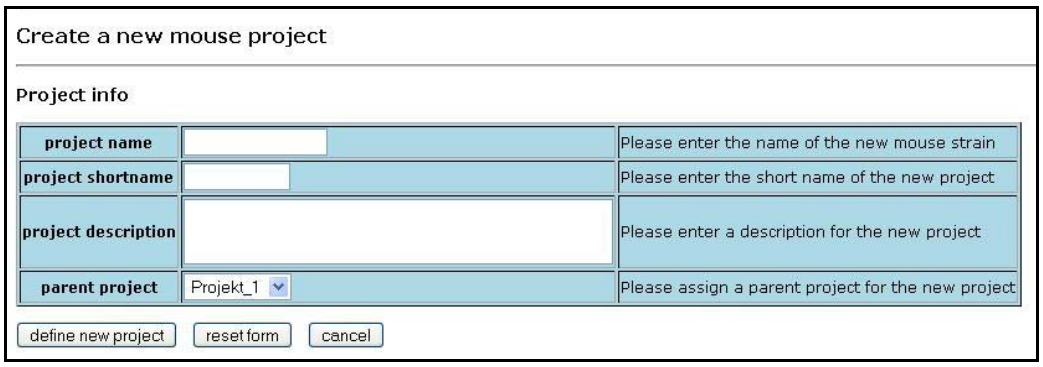



**Figure 3: Define a project – name, short name, description and parent project may be given.**

### 3.4.4 Defining experiments (admin function)

In this context an experiment is a description of examinations that shall be performed on laboratory animals which require a concession from any kind of regulatory authority. It is

recommended to enter the reference number as experiment name. As there are no comment fields the experiment name should be self-documenting.

In order to track experiment assignment of individual mice, experiment need to be defined.

As admin, choose ***settings → new experiment.***

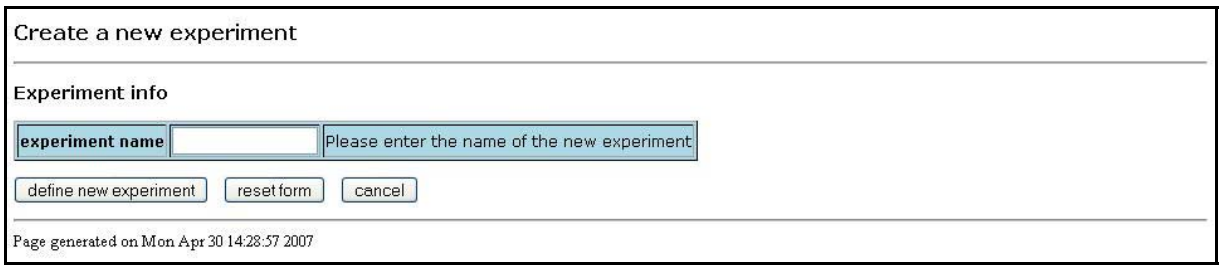



**Figure 4: Define a new experiment – only the experiment name is needed.**

### 3.4.5 Defining cost centres (admin function)

You may want to calculate the sum of days mice were housed in your facility in order to charge the costs of animal husbandry to someone.

In order to track cost centre assignment of individual mice, cost centres need to be defined.

As admin, choose ***settings → new cost centre.***

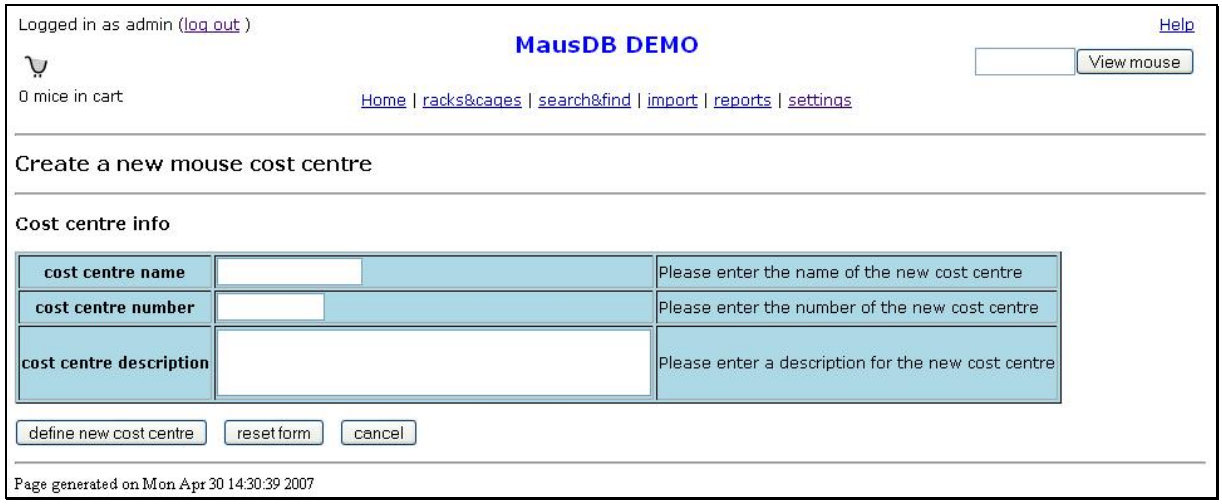



**Figure 5: Define a new cost centre – name, number and description need to be given.**

### 3.4.6 Defining users (admin function)

Working as a multi-user system with role-specific functionality and account-specific default views and privileges, MausDB requires the definition of user accounts.

As admin, choose ***settings → new user.***

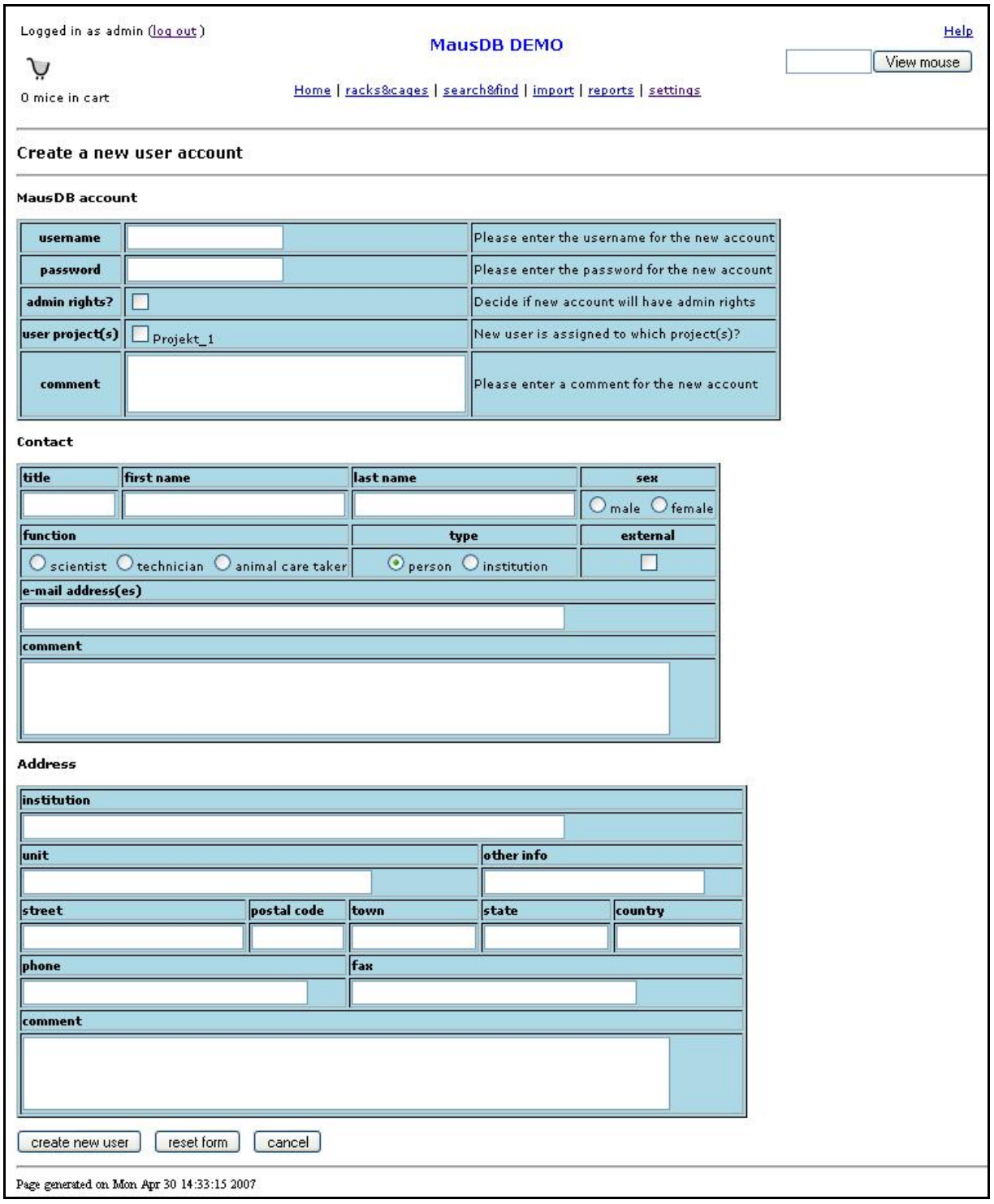



**Figure 6: Define a new user account – lots of information can be entered.**

### 3.4.7 Defining genotypes (admin function)

In order to assign genotypes to mice, the distinct genotype flags (e.g. „+/+“,„+/-“,...) need to be defined.

As admin, choose ***settings → new genotype.***

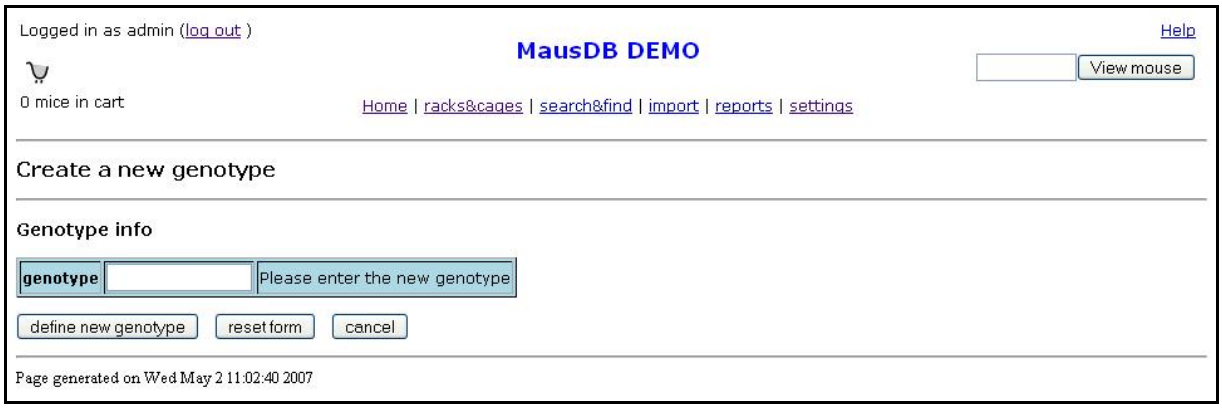



**Figure 7: Define a genoype – something like „+/+“, „+/-„, „wildtype“, ... can be entered.**

### 3.4.8 Configuring email address(es) for admin user(s)

In some cases, MausDB automatically sends email notifications to defined recipients, e.g. upon the generation of new mouse lines via the web user interface.

To this end, email addresses for notification recipients need to be defined in the database.

**Start the mysql console**

```
# mysql –u <user> –p<password> mausdb
```

**Define email addresses(es)**

```
mysql> update settings
       set setting_value_text = ’<email address>’
       where setting_item = ’admin_mail’;
```

# 4 Working with MausDB (for all users)

## *4.1 Some basic concepts*

There are some basic concepts that you need to understand before working with MausDB. At least, it makes working with MausDB much easier...

### 4.1.1 Everything has an ID

Everything needs to have an ID in databases. This is also true for MausDB, since MausDB is a database application.

Every mouse has an 8 digit numeric mouse ID in MausDB. It is the main and unique identifier of a mouse in the system. Every mouse-specific data and information is attached to the mouse ID. In other words: there is no concept of “anonymous” mice in MausDB.

The same is true for all other entities in MausDB, where entity means a data representation of physical (rooms, racks, cages, ...) or abstract (matings, projects, ...) objects.

### 4.1.2 How mice get into MausDB: import and weaning

A mouse can enter MausDB in either of three ways:

- by **import** from an external source. All mouse-specific properties have to be defined at import time.
- by **weaning** litter, where litter is defined as the set of siblings originating from a mating that has been defined in MausDB. Most properties are inherited
- by **embryo transfer** (which is a special case of mating/weaning)

### 4.1.3 Two worlds: „real world“ vs „database world“

As every other comparable database application, MausDB uses a structured database model of the real world (i.e. the physical mice, cages, racks, rooms and other relevant things like users, projects, genotypes, ...) to store, link and display data.

Of course, a precondition for proper function of MausDB is congruence of information in both worlds. For example, a mouse is physically moved from cage 1234 to cage 2345. After that “real world” action, this cage transfer has also to be performed in the “database world”, i.e. MausDB, in order to reconstitute a proper database.

One basic principle is not to disallow actions in MausDB that can be done in the real/physical world, but rather only display a warning. Also managing grants to allow/disallow actions (kill, move, ...) on a user/project base makes no sense if there are no such mechanisms in the real world. This works well in the German Mouse Clinic.

## 4.2 Getting started...

### 4.2.1 Logging in to MausDB

In order to work with MausDB, you need to login in to the application. Point your Mozilla Firexfox browser to the appropriate URL given by your administrator (e.g. „http://mausdbwww.yourdomain/cgi-bin/mausdb/mausdb.cgi“). Enter username and password for your account to get access to MausDB.

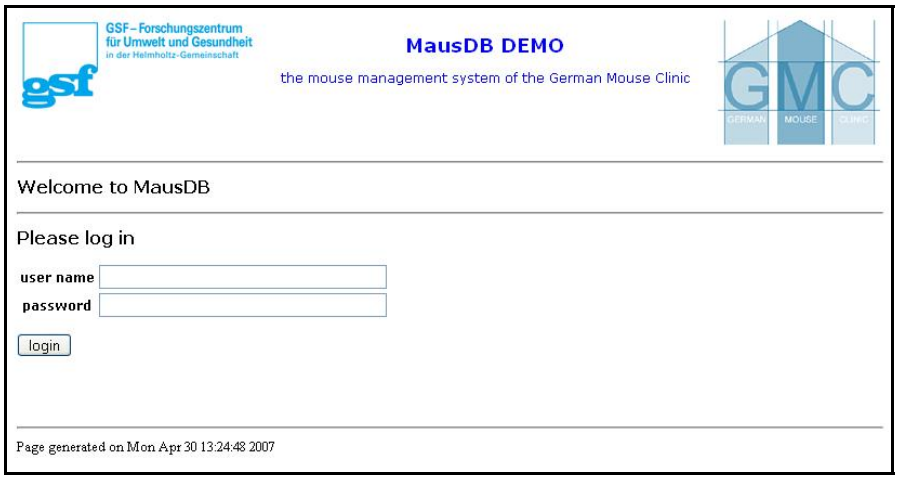



**Figure 8: MausDB authentication screen – login to specific user account is required.**

### 4.2.2 The „Home“ area

Following authentication, a user-specific „Home“ view is displayed. User and project specific information is displayed here.

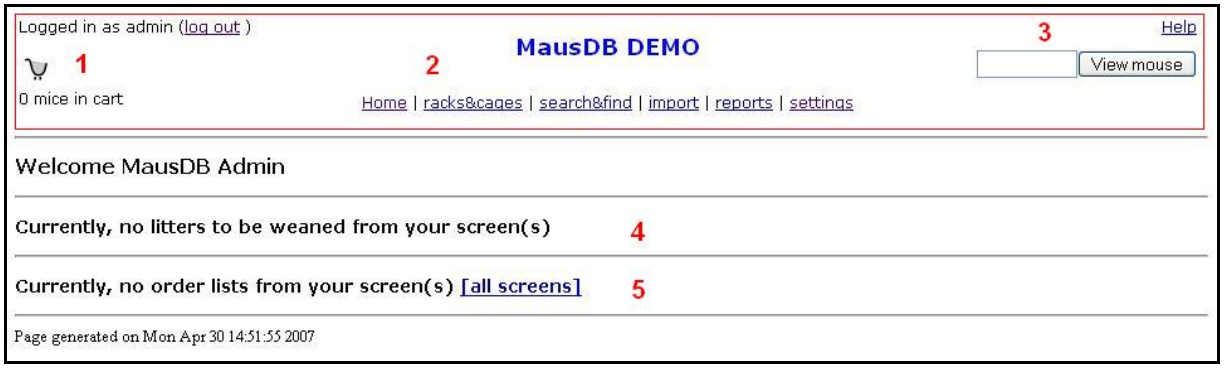



**Figure 9: User-specific „Home“ area. Area 1 shows login information and the log out button as well as the cart symbol and cart information. Area 2 is the main navigation bar. Area 3 contains a help link and the mouse quickfinder form. Area 4 can contain a list of user-assigned litters. Area 5 can contain a list of scheduled user tasks.**

The next figure shows an example where litters and tasks are scheduled:

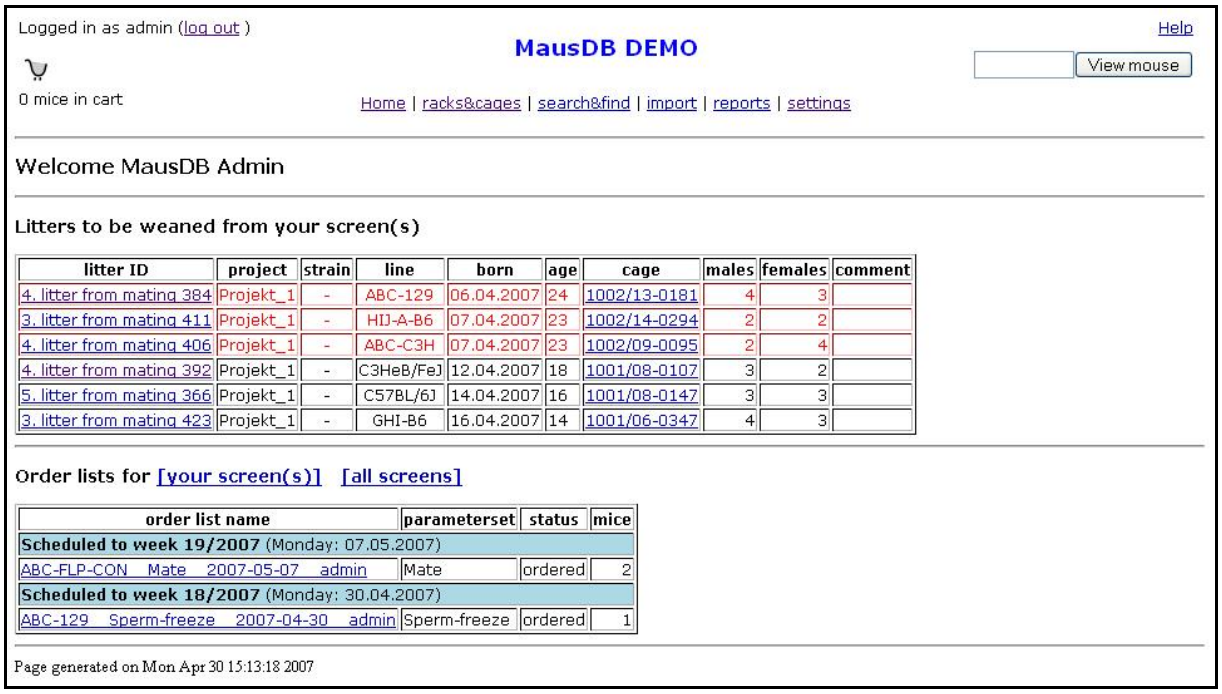



**Figure 10: User-specific „Home“ area with examples. Six litters assigned to the user's project have been reported to MausDB. Litters that are ready to wean (i.e. 21 days or older) are displayed in red. Clicking the link in the leftmost column directly leads to the weaning dialog. Two tasks have been scheduled for the user. The tasks are ordered by their scheduled week. Clicking the link directly leads to the task list where the task list can be viewed or modified.**

### 4.2.3 Changing the password

The password can be changed at any time via ***settings → change password***. The password should be changed during the first MausDB session or after an administrator set a new password, respectively. In either case, the previous password must be entered before entering the new password twice. After changing the password, a login is enforced.

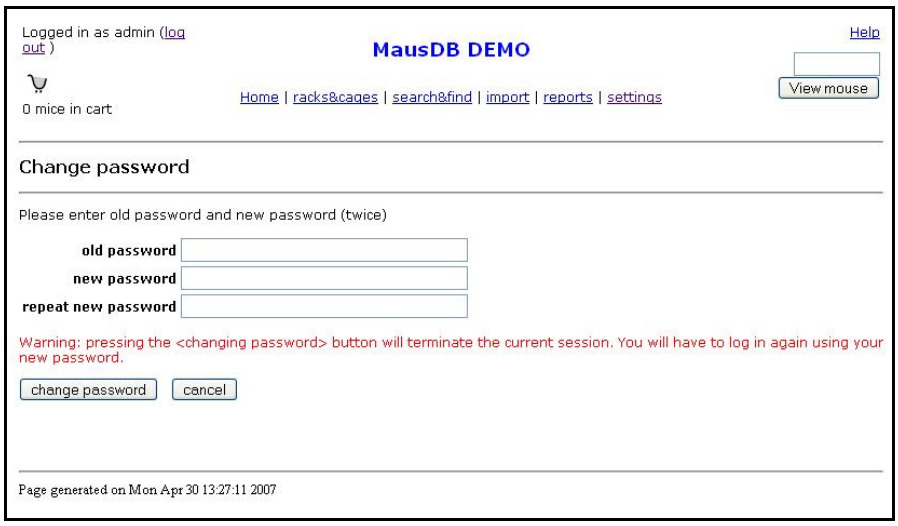



**Figure 11: The „Change password“ - screen.**

## 4.3 The Quickfinder tool – find mice and cages

Using the quickfinder input window (upper right corner of the MausDB user interface), you can access details about a specific mouse or a cage very fast. Just enter the 8 digit mouse ID or a cage ID into the form and press the ***"View mouse/cage"*** button. Alternatively, you may place the cursor into the form and read a mouse ID or cage ID barcode with a barcode reader from a printed cage card.

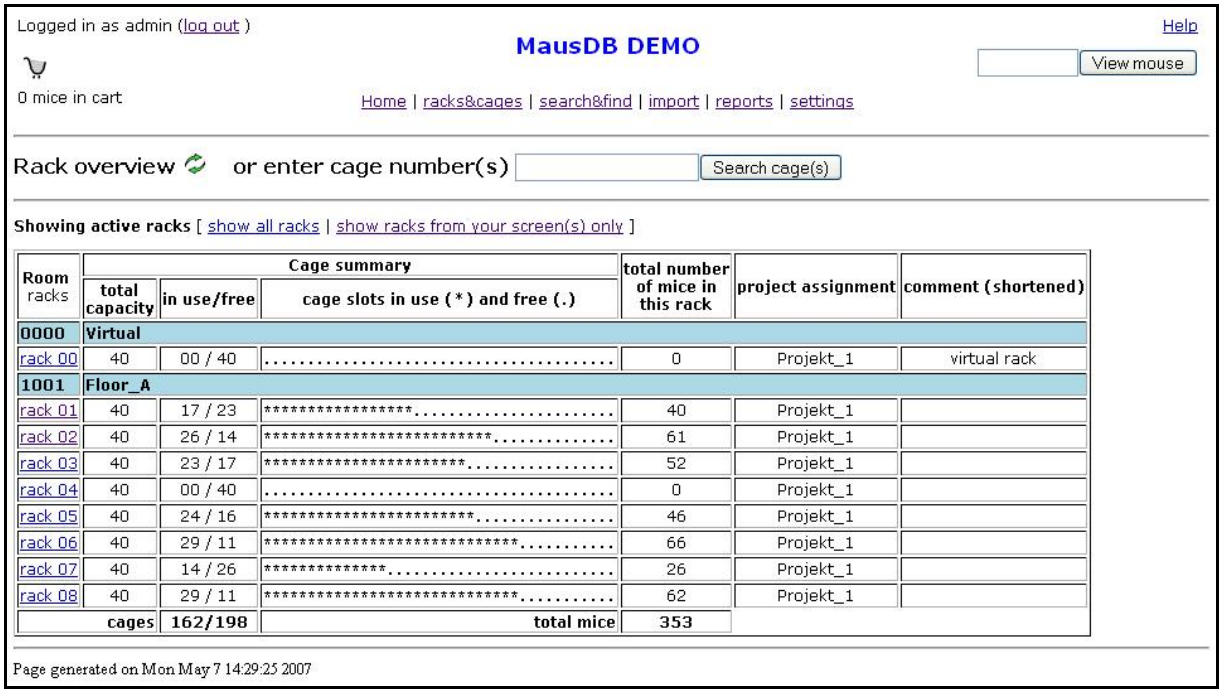
In either case, entering a valid mouse ID from an existing mouse will result in being forwarded to the "mouse details" or the cage view (see 4.6) of this particular mouse/cage.

## 4.4 Locating mice – browse "racks&cages"

Locating mice by browsing racks and cages is a straight forward approach since it does not require prior knowledge about mice such as line, sex, or genotype.

### 4.4.1 Rack overview

Choose ***racks&cages*** from the main menu.




| Room racks | Cage summary: total capacity | in use/free | cage slots in use (*) and free (.) | total number of mice in this rack | project assignment | comment (shortened) |
|---|---|---|---|---|---|---|
| 0000 | Virtual | | | | | |
| rack 00 | 40 | 00 / 40 | ..... | 0 | Projekt_1 | virtual rack |
| 1001 | Floor_A | | | | | |
| rack 01 | 40 | 17 / 23 | *****..... | 40 | Projekt_1 | |
| rack 02 | 40 | 26 / 14 | *****..... | 61 | Projekt_1 | |
| rack 03 | 40 | 23 / 17 | *****..... | 52 | Projekt_1 | |
| rack 04 | 40 | 00 / 40 | ..... | 0 | Projekt_1 | |
| rack 05 | 40 | 24 / 16 | *****..... | 46 | Projekt_1 | |
| rack 06 | 40 | 29 / 11 | *****..... | 66 | Projekt_1 | |
| rack 07 | 40 | 14 / 26 | *****..... | 26 | Projekt_1 | |
| rack 08 | 40 | 29 / 11 | *****..... | 62 | Projekt_1 | |
| | cages | 162/198 | total mice | 353 | | |

**Figure 12: The rack overview lists all user assigned racks per default. The leftmost column contains clickable rack links, ordered by room. The second column shows the rack capacity (number of cage slots).**

### 4.4.2 Rack view

Following a link from the rack overview an individual rack with all current cages can be displayed.

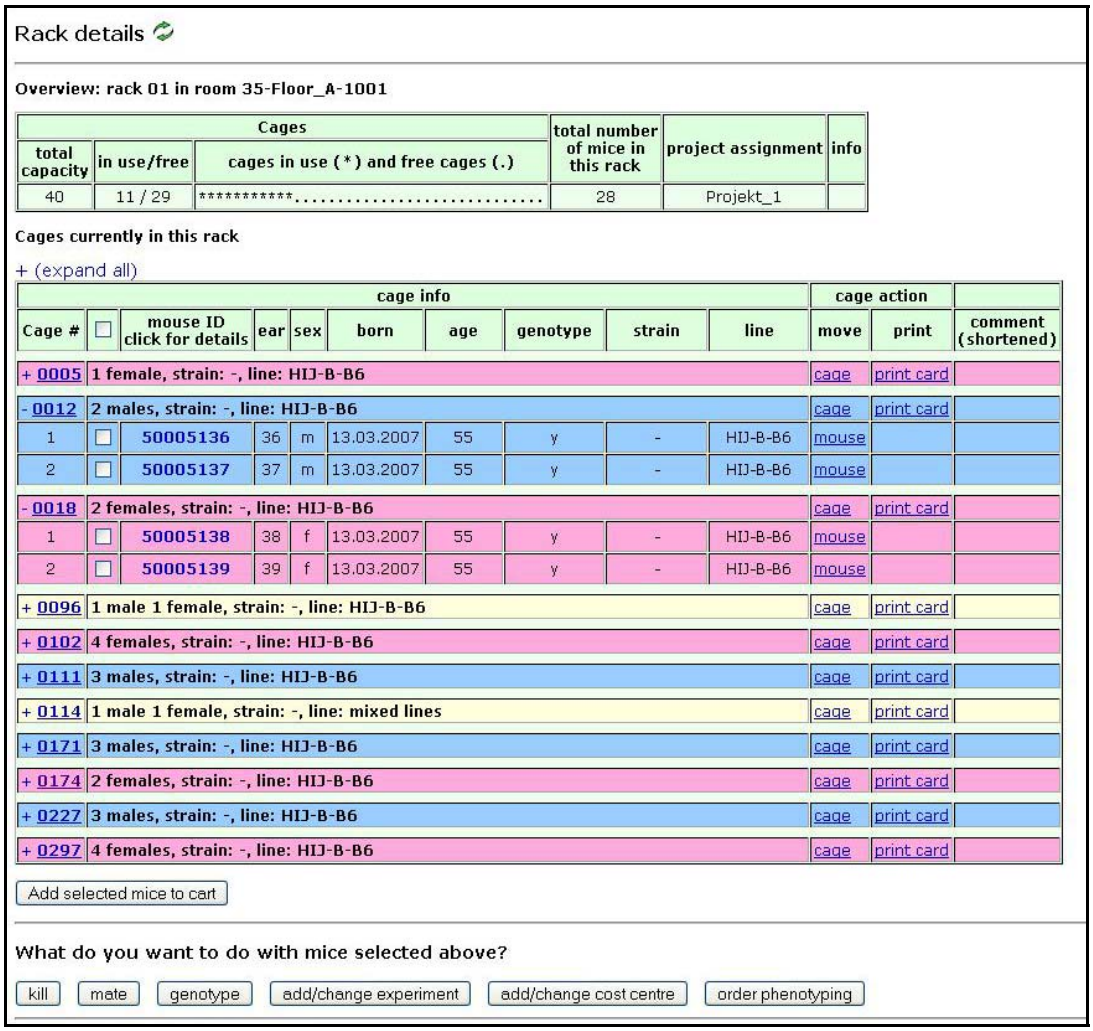



**Figure 13: Rack details view. In this view, all cages of a chosen rack can be viewed showing one cage per row (condensed view, e.g. cage 0005). A click on the cage id in the first column leads to a detailed cage view. Clicking the „cage“ link will start a cage transfer dialog (see 5.10), whereas clicking „print card“ will open a cage card preview in a new window (see 4.4.4).**

**Cages can be expanded using the ‚+’ switch on the left hand side of the cage id in the first column (expanded view, e.g. cage 0012). Basic information of individual mice is displayed along with a clickable mouse ID, which leads to a mouse details view (see 4.6). Clicking the „mouse“ link will start a mouse transfer dialog (see 5.9). Mice can be selected across cages and be put in the cart (see 4.5) by checking the box in the second column and pressing the „Add selected mice to cart“ button.**

**Some actions can be applied on selected mice using the buttons in the bottom row, e.g. „kill“ (see 5.11), „mate“ (see 5.1), „genotype“ (see 5.6).**

### 4.4.3 Cage view

Following a link from the rack view or any other mouse table, an individual cage with all mice can be displayed.

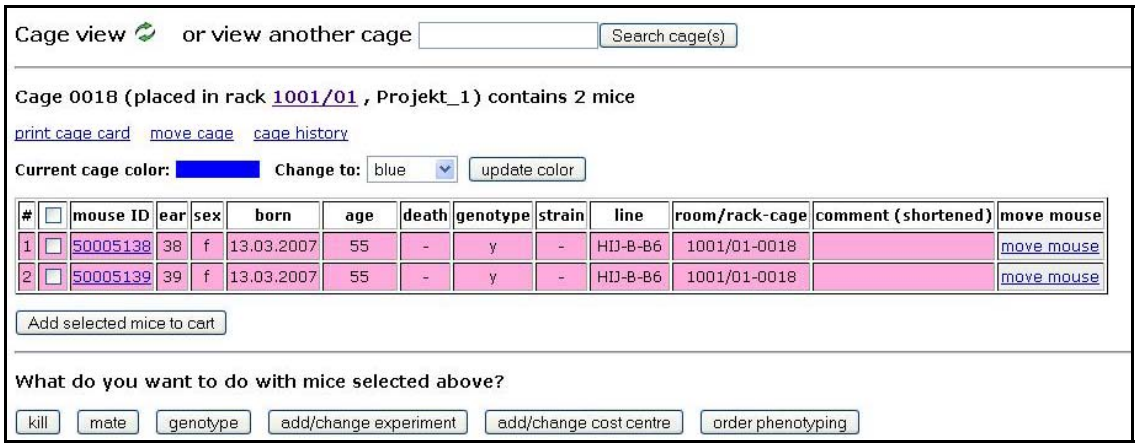



**Figure 14: Cage view. Basic details of all mice in a cage are displayed along with their clickable mouse ID, which will lead to a mouse details view (see 4.6). Clicking the „move mouse" link will start a mouse transfer dialog (see 5.9). Again, mice can be selected for actions available on the bottom button bar or for being put in the cart (see 5.5). Just on top of the mice table, there are links for printing a cage card (see 4.4.4), for starting a cage transfer dialog (see 5.10), or for viewing the history of the cage ID (see 4.7.2). The color of the cage card color bar can be adjusted as well.**

### 4.4.4 Cage card

Cage cards can be printed by clicking on the respective links in the rack view (see 4.4.2) and cage view (see 4.4.3).


**Figure 15: Cage card. Left part: in the top row, room (1001) and rack (01) are denoted on the left, the cage ID (0297) is printed on the right, whereas the color bar is centred. Mouse specific rows contain mouse ID, eartag, sex and date of birth in the first line. Strain (background) and line information are printed on the second line. Genotype information is given in the third line and comments on the fourth line. Right part: in the top row, the cage ID is barcoded. Mouse specific rows contain a barcode of the mouse ID together with sex, mouse ID and eartag. The origin of the mouse (M: mating/weaning; I: import) with the correspondent mating or import ID is given. IDs of father and mother are printed below.**

## 4.5 Collecting and grouping mice – the cart

In MausDB, the so-called cart plays an important role for collecting and grouping mice. Most functions can be carried out via a three-step procedure, some functions even require it:

- first step: locate and identify a set of mice
- second step: select mice and put them into the cart
- third step: open the cart and apply a function on selected mice in the cart

Putting mice in a cart is like writing a mouse ID on a piece of paper. Being listed in the cart does not affect or change properties of that mouse in the database at all. Removing a mouse from the cart also does not affect or remove the mouse from the database.

The cart content (i.e. a set of mice) is bound to a browser session which means the user-specific cart is emptied after logout. However, the current cart can be permanently stored to the database. Thus, grouping of mice is made possible. No matter where mice are caged, no matter if mice died in the meantime, they stay in the cart.


**Figure 16: The cart symbol indicates that there are two mice in the cart. Clicking on the cart symbol leads to the cart view.**

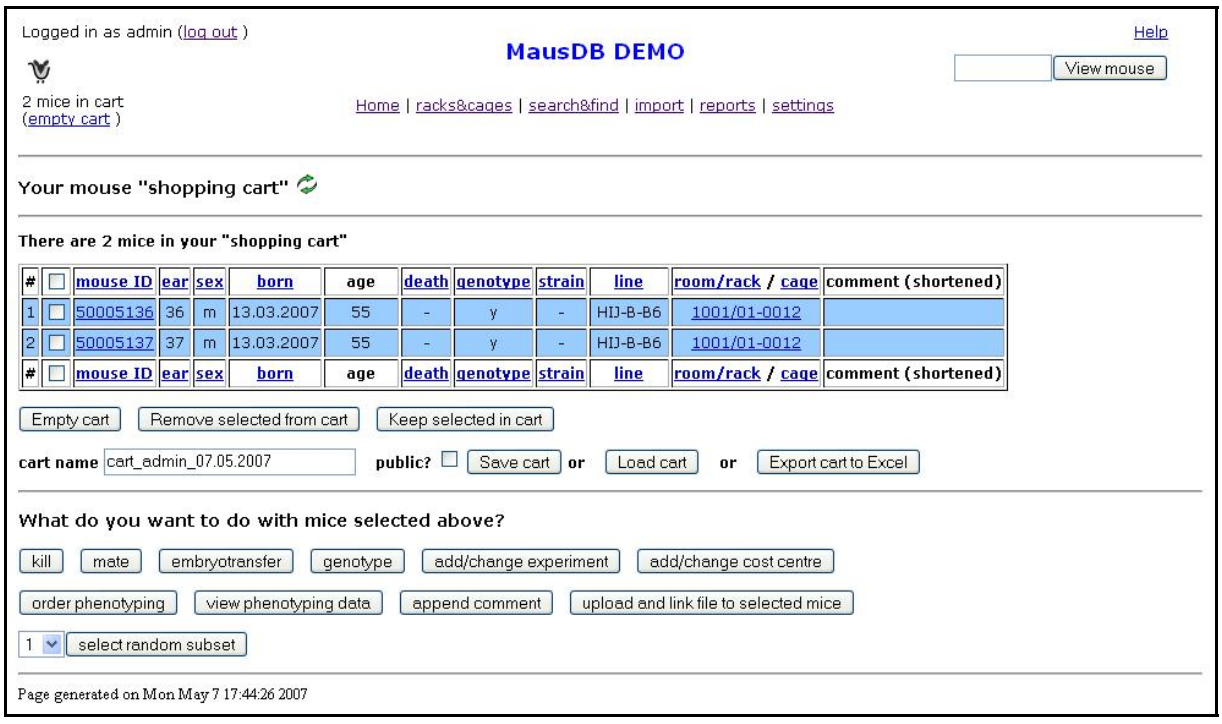



**Figure 17: The cart. All mice in the cart are displayed one per row. Mouse ID, room/rack and cage numbers are clickable and lead to the respective detail views. Cart management functions are available directly below the mouse table. Mouse specific functions are made available on the lower part .They are either self-explaining or explained in detail elsewhere in this manual.**

## 4.6 All about a mouse - the "Mouse details" page

Since the mouse ID is the unique identifier of a mouse in MausDB, it is displayed as a clickable link almost everywhere. Clicking on the mouse ID will directly lead to the "mouse details" view.

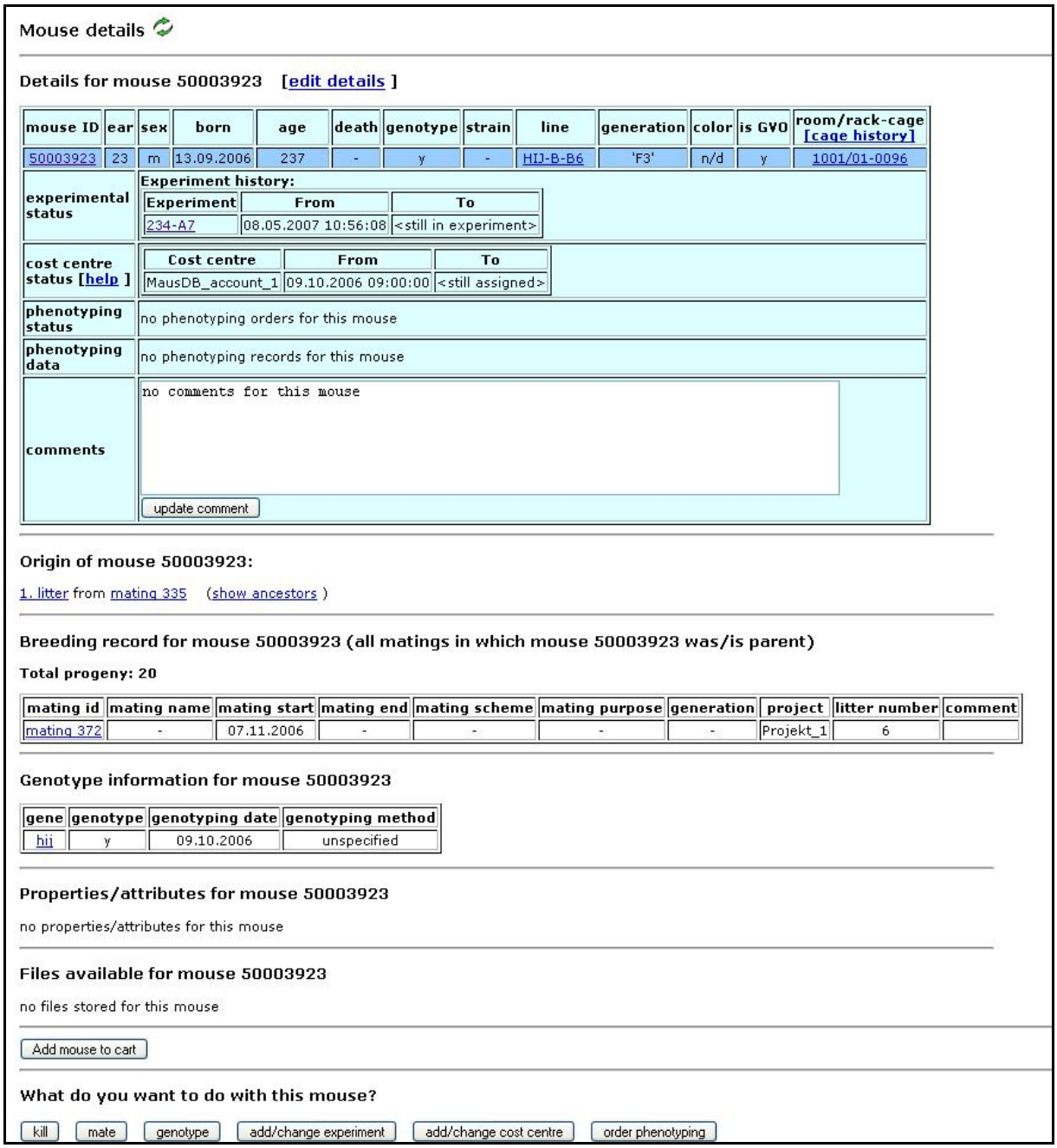



**Figure 18: Mouse details view. On top of the box, the „edit details" link leads to a dialog where some mouse specific details can be modified (see Figure 19). Top box: the top row contains individual mouse data. „GVO" is the German acronym for„genetically modified organism". On top of the room/rack/cage information, the „cage history" link leads to a detailed cage history of the current individual mouse (see 4.7.1). Assignment to an experiment and cost centre assignment are given with time ranges. Below box: the origin information indicates whether a mouse origins from a weaning or from an import. For weaned mice, links to littermates („litter", see 4.7.5), parents („mating", see 4.7.4) and ancestors („show ancestors", see 4.7.3) are given. For imported mice, a link to the respective import (see 0) is displayed. The „Breeding record" table shows every mating, in which the current mouse is/was mating partner. The „Genotype information" panel shows all genotype data for the current mouse. Properties (e.g. foreign IDs for imported mice) and attached files are listed if available.**

By following the “edit details” link in the previous figure the following page is displayed:

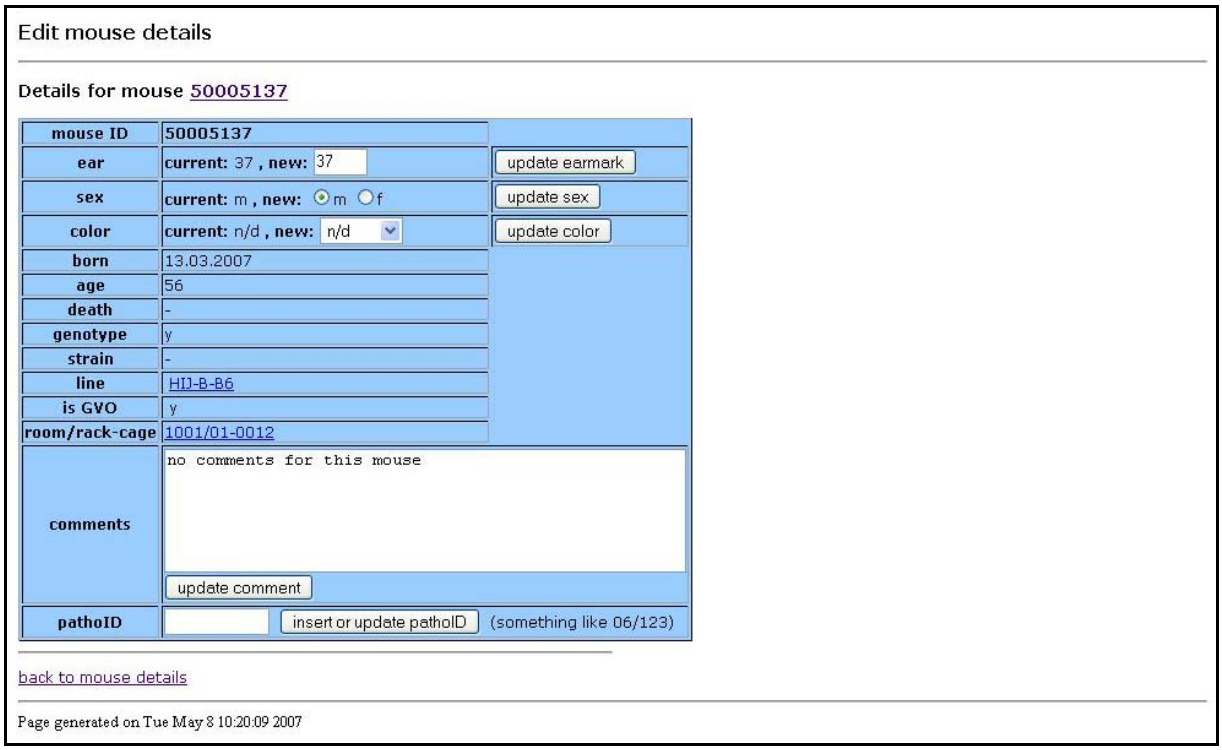



**Figure 19: Edit mouse details. Some individual mouse properties (eartag, sex, color and comment) can be changed here. Other properties like for example date of birth not only affect an individual mouse, but a whole litter and therefore must be changed by a trained administrator on the SQL level.**

## *4.7 Some more informational views ...*

### 4.7.1 Cage history of a mouse

Sometimes it is not only important to know where a mouse is currently located, but also in which rack and cage a mouse was housed in the past together with which cage mates. This kind of detailed cage history can be viewed with MausDB easily:

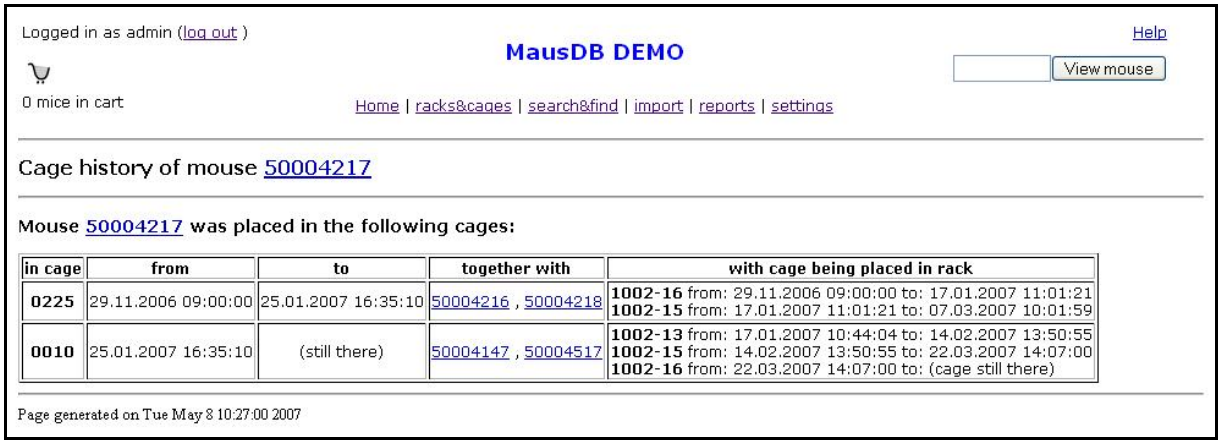
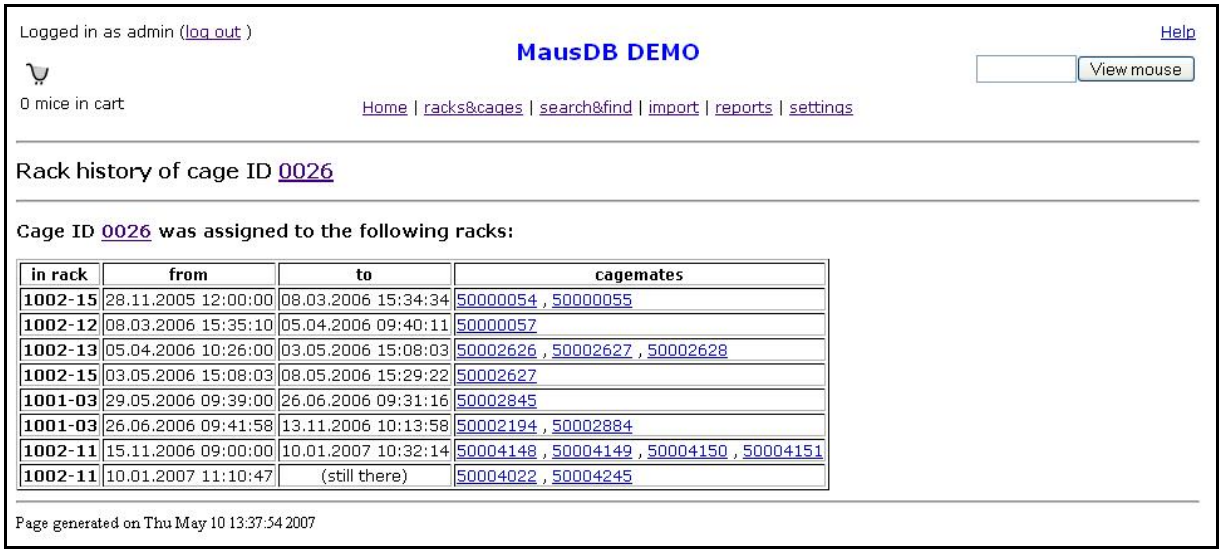



**Figure 20: Cage history of a mouse. The complete cage transfer history of a mouse is recorded and can be viewed for sanitary purposes, for example. The time range (from-to) of cage allocation is given in a a row for every cage a mouse has been placed in the past up to present time. Cagemates of the current mouse are given for the respective cage and time in the fourth column. For every cage, the rightmost column lists the rack allocation during the respective time range.**

### 4.7.2 Rack history of a cage

Sometimes it is interesting to know in which racks a cage was placed in the past. To be exact: to which racks a cage ID was assigned in the past, since cage IDs are being reused in MausDB and are not an attribute of a physical cage. Such a detailed rack history of a cage can be easily viewed with MausDB and is available by a link from the respective cage view (see 4.4.3).




| in rack | from | to | cagemates |
|---|---|---|---|
| 1002-15 | 28.11.2005 12:00:00 | 08.03.2006 15:34:34 | 50000054 , 50000055 |
| 1002-12 | 08.03.2006 15:35:10 | 05.04.2006 09:40:11 | 50000057 |
| 1002-13 | 05.04.2006 10:26:00 | 03.05.2006 15:08:03 | 50002626 , 50002627 , 50002628 |
| 1002-15 | 03.05.2006 15:08:03 | 08.05.2006 15:29:22 | 50002627 |
| 1001-03 | 29.05.2006 09:39:00 | 26.06.2006 09:31:16 | 50002845 |
| 1001-03 | 26.06.2006 09:41:58 | 13.11.2006 10:13:58 | 50002194 , 50002884 |
| 1002-11 | 15.11.2006 09:00:00 | 10.01.2007 10:32:14 | 50004148 , 50004149 , 50004150 , 50004151 |
| 1002-11 | 10.01.2007 11:10:47 | (still there) | 50004022 , 50004245 |

**Figure 21: Rack history of a cage. For a given cage ID, the table lists previous and current assignments to racks (column 1) with the relevant time range (columns 2-3).**

### 4.7.3 Ancestor table

In order to trace back the ancestors of an individual mouse over generations, an ancestor tree is the most convenient way to do so. MausDB uses an ancestor table to show parents of mice together with genotype information (see Fig. 22). In case of very wide ancestor trees a link (more) is given which can be followed to use the particular mouse as the root of a new ancestor tree.

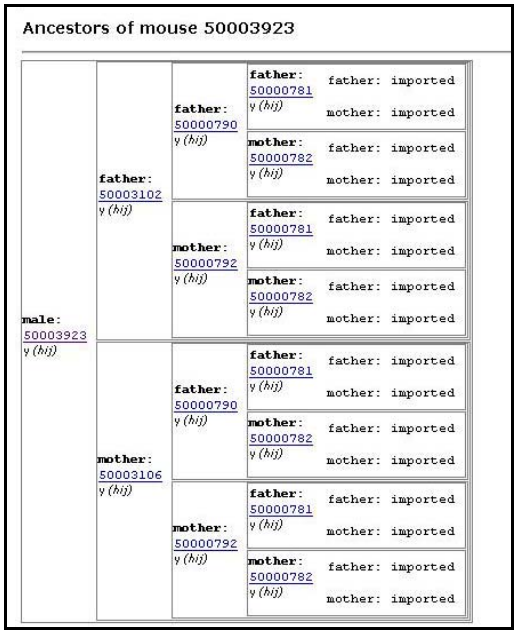



**Figure 22: Ancestor table. The mouse for which the ancestor table was called is displayed on the left. Next to it on the right side, father and mother ID along with genotype information are shown and so on.**

### 4.7.4 Mating details view

In the mating details view, mating partners and litters of a defined mating are shown in an overview. How to set up a mating in MausDB is described step by step in chapter 5.1.

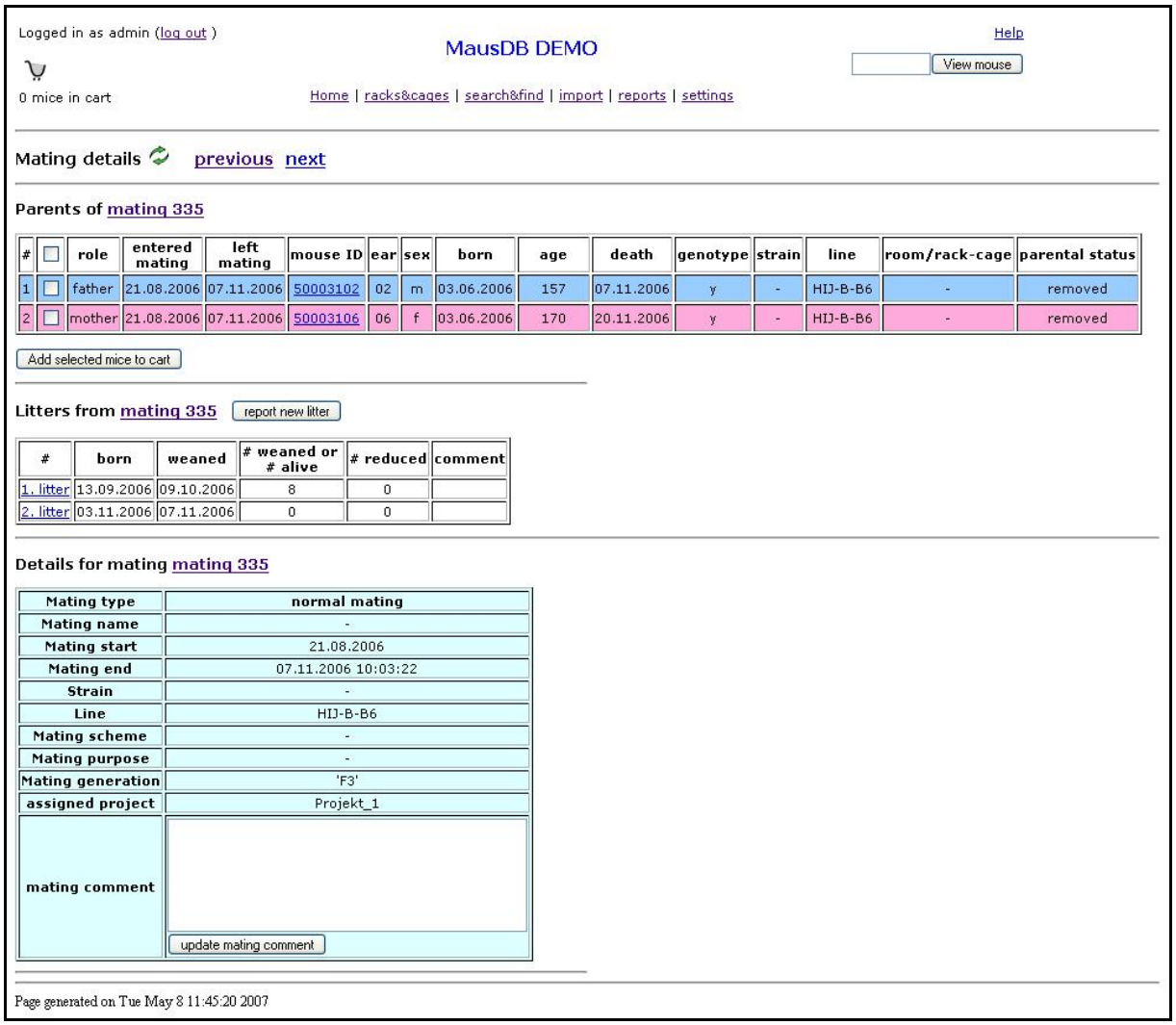



**Figure 23: Mating details. The top table contains the mating partners, i.e. the parents. The second table shows all litters produced in the course of the mating so far. Clicking on the litter link in the leftmost column leads to the litter view (see 4.7.5). Additional litters can be reported by clicking on the „report new litter“ button. The bottom table shows mating details, for example mating start, mating end, line offspring line, comment.**

### 4.7.5 Litter view

In the litter view, parents and littermates of an individual litter are shown together with litter details, for example date of birth, date of weaning, and comment.

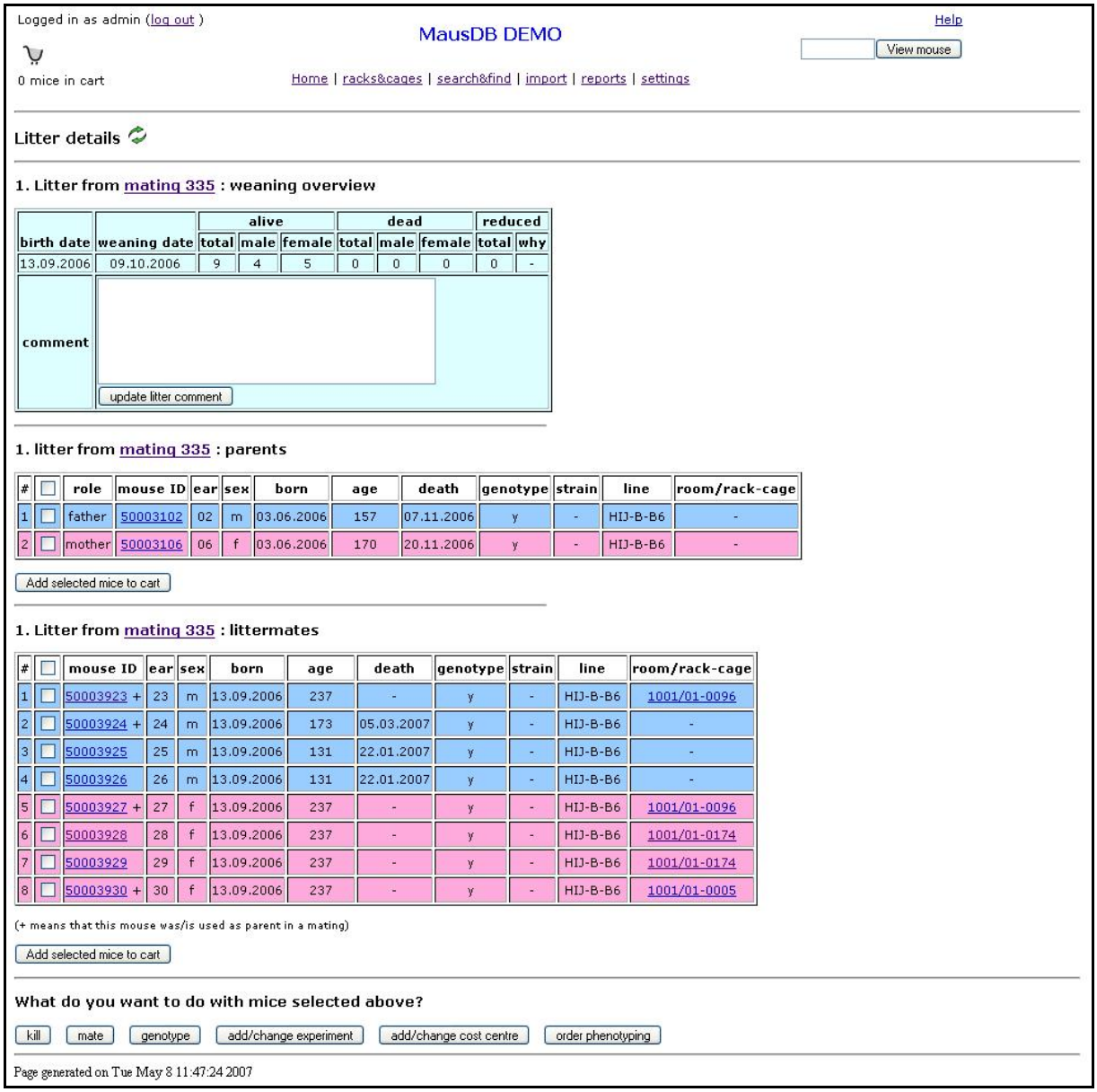



**Figure 24: Litter view. The top box shows litter details, for example date of birth, date of weaning, and comment. The parents table shows parent mice of the current litter. The bottom table lists all littermates of the current mating. '+' after mouse ID indicates that a mouse has been partner in a mating itself. Parents as well as littermates can be selected and either put in the cart or used for actions that are made available by function buttons on the very bottom.**

### 4.7.6 Import view

As every import defines an individual batch of mice, the import view shows all information about an import. How to set up an import in MausDB is described step by step in chapter 5.5.

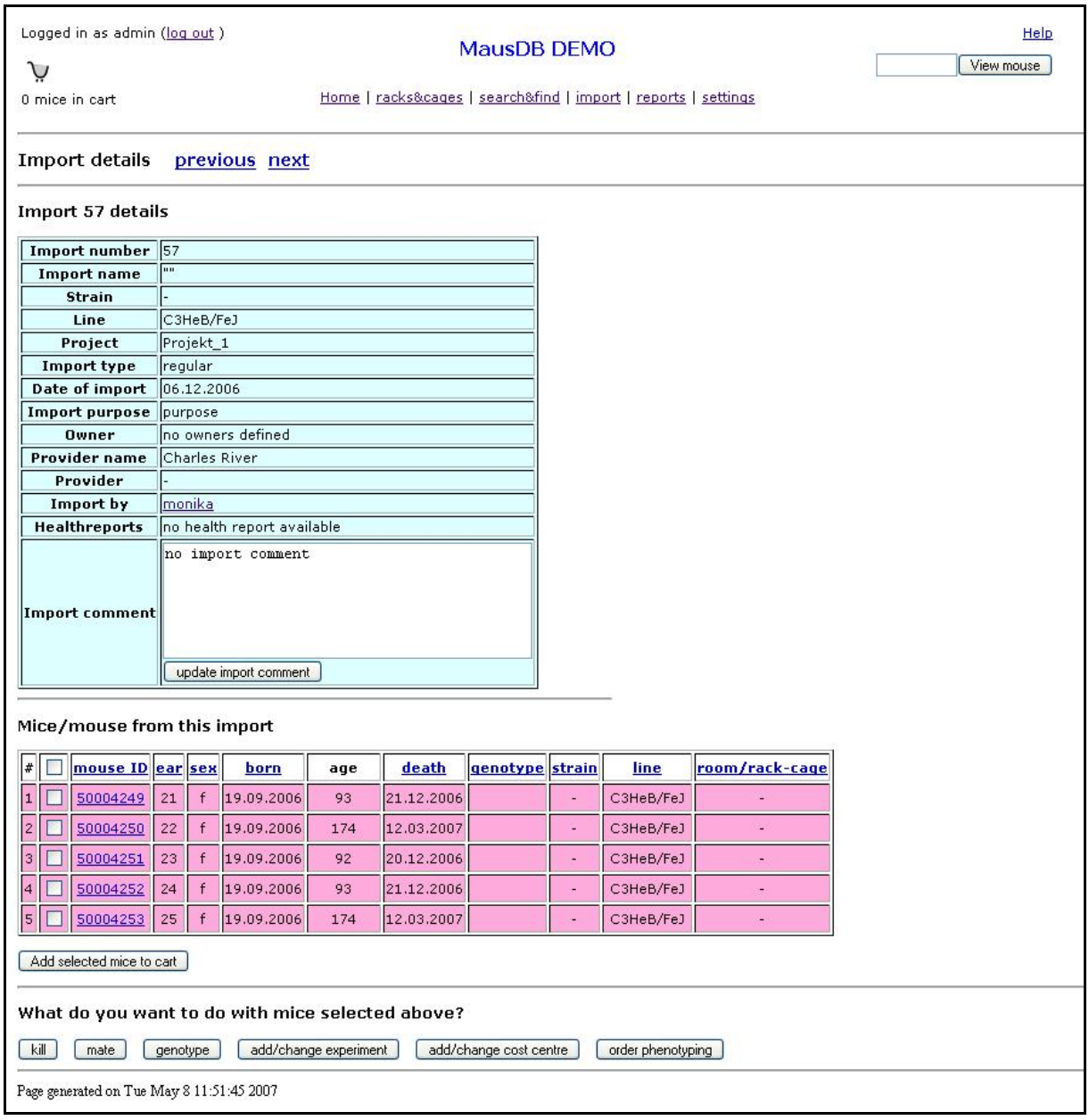



**Figure 25: Import details. The top box shows import specific information. The table lists all mice that belong to this import. Mice can be selected and either put in the cart or used for actions that are made available by function buttons on the very bottom.**

## 4.8 Finding mice by properties – the "search&find" page

In order to find mice not by their location (i.e. rack and cage browsing), but based on other properties, the search&find functions of MausDB can be used.

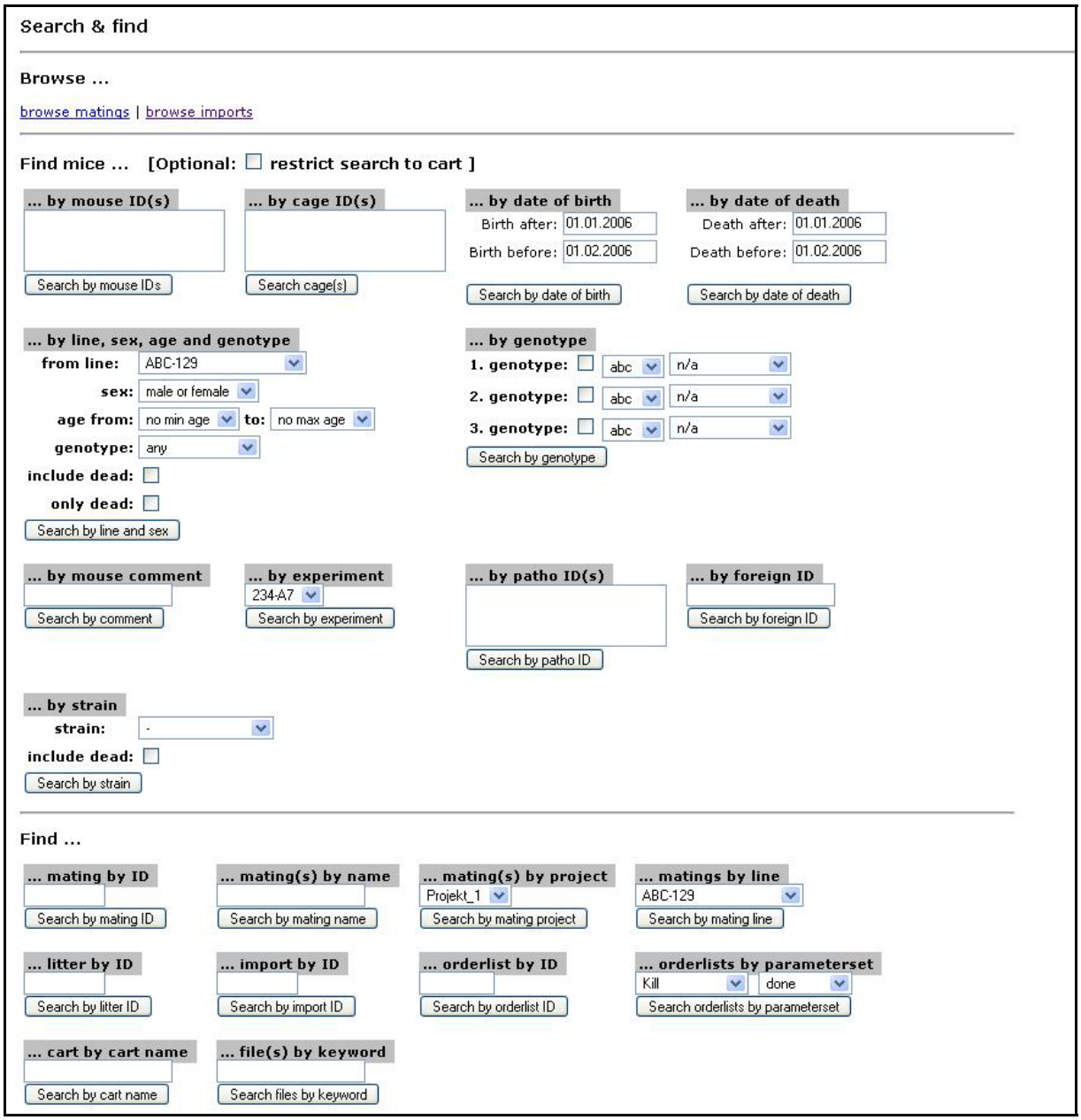
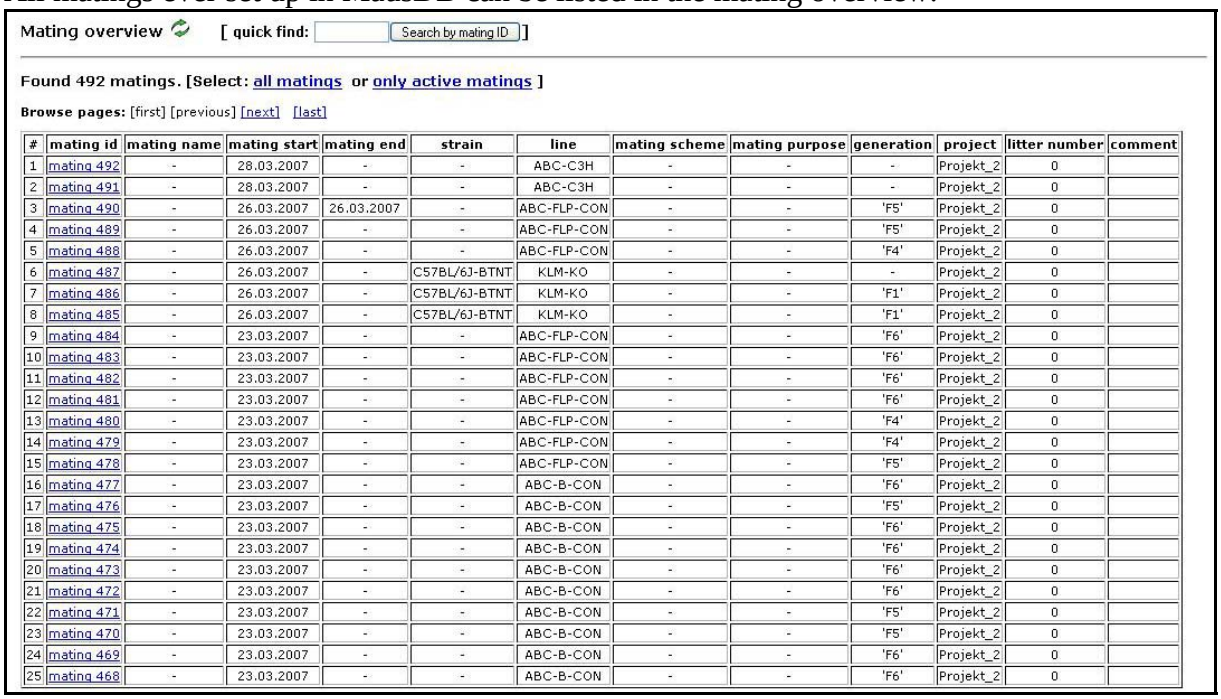



**Figure 26: Search&Find page. Top section: Clicking „browse matings" leads to a mating overview (see 4.8.1), clicking „browse imports" leads to an import overview (see 4.8.2). Middle section: Mice can be searched for by different criteria. The result set will always be a list of mice. Optionally, searches in this section can be restricted to mice currently in the cart, which allows concatenation of different searches. The input fields „... by mouse ID(s)" and „... by cage ID(s)" accept any input, for example a whole spreadsheet colum copied via the clipboard. IDs contained in this input will be recognized automatically. Bottom section: Other entities than mice can be searched in this section, for example matings, imports, carts, and others. Searches in this section cannot be restricted to the cart. Input fields for name or comment searches accept multiple terms that are combined by logical AND.**

### 4.8.1 Mating overview

All matings ever set up in MausDB can be listed in the mating overview.



Mating overview [ quick find: Search by mating ID ]

Found 492 matings. [Select: all matings or only active matings ]

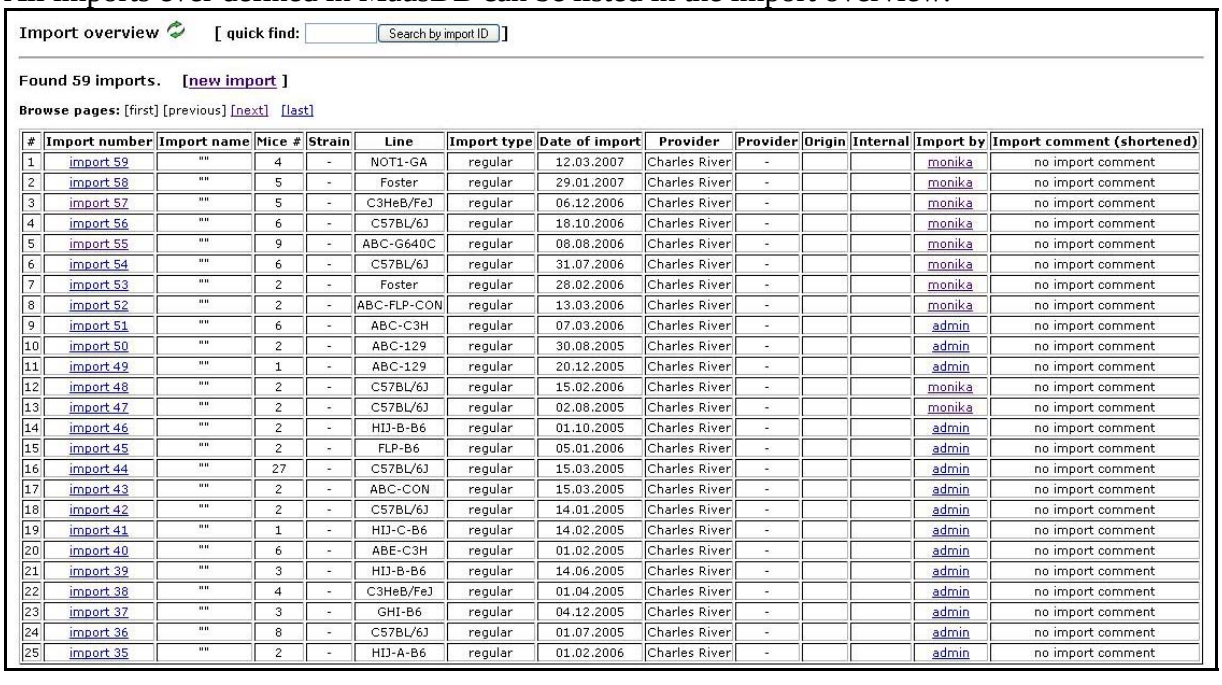
Browse pages: [first] [previous] [next] [last]

| # | mating id | mating name | mating start | mating end | strain | line | mating scheme | mating purpose | generation | project | litter number | comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | mating 492 | - | 28.03.2007 | - | - | ABC-C3H | - | - | - | Projekt_2 | 0 | |
| 2 | mating 491 | - | 28.03.2007 | - | - | ABC-C3H | - | - | - | Projekt_2 | 0 | |
| 3 | mating 490 | - | 26.03.2007 | 26.03.2007 | - | ABC-FLP-CON | - | - | 'F5' | Projekt_2 | 0 | |
| 4 | mating 489 | - | 26.03.2007 | - | - | ABC-FLP-CON | - | - | 'F5' | Projekt_2 | 0 | |
| 5 | mating 488 | - | 26.03.2007 | - | - | ABC-FLP-CON | - | - | 'F4' | Projekt_2 | 0 | |
| 6 | mating 487 | - | 26.03.2007 | - | C57BL/6J-BTNT | KLM-KO | - | - | - | Projekt_2 | 0 | |
| 7 | mating 486 | - | 26.03.2007 | - | C57BL/6J-BTNT | KLM-KO | - | - | 'F1' | Projekt_2 | 0 | |
| 8 | mating 485 | - | 26.03.2007 | - | C57BL/6J-BTNT | KLM-KO | - | - | 'F1' | Projekt_2 | 0 | |
| 9 | mating 484 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 10 | mating 483 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 11 | mating 482 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 12 | mating 481 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 13 | mating 480 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F4' | Projekt_2 | 0 | |
| 14 | mating 479 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F4' | Projekt_2 | 0 | |
| 15 | mating 478 | - | 23.03.2007 | - | - | ABC-FLP-CON | - | - | 'F5' | Projekt_2 | 0 | |
| 16 | mating 477 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 17 | mating 476 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F5' | Projekt_2 | 0 | |
| 18 | mating 475 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 19 | mating 474 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 20 | mating 473 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 21 | mating 472 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 22 | mating 471 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F5' | Projekt_2 | 0 | |
| 23 | mating 470 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F5' | Projekt_2 | 0 | |
| 24 | mating 469 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |
| 25 | mating 468 | - | 23.03.2007 | - | - | ABC-B-CON | - | - | 'F6' | Projekt_2 | 0 | |

**Figure 27: Mating overview. All matings are shown by default and multiple result pages can be browsed using the „first“ (= most recent), „previous“, „next“, and „last“ links. Matings can be filtered to show „only active matings“, which means matings for which no end date is defined. Clickable mating IDs lead to the detailed mating view of the individual mating.**

### 4.8.2 Import overview

All imports ever defined in MausDB can be listed in the import overview.



Import overview [ quick find: Search by import ID ]

Found 59 imports. [new import ]

Browse pages: [first] [previous] [next] [last]

| # | Import number | Import name | Mice # | Strain | Line | Import type | Date of import | Provider | Provider | Origin | Internal | Import by | Import comment (shortened) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | import 59 | "" | 4 | - | NOT1-GA | regular | 12.03.2007 | Charles River | - | | | monika | no import comment |
| 2 | import 58 | "" | 5 | - | Foster | regular | 29.01.2007 | Charles River | - | | | monika | no import comment |
| 3 | import 57 | "" | 5 | - | C3HeB/FeJ | regular | 06.12.2006 | Charles River | - | | | monika | no import comment |
| 4 | import 56 | "" | 6 | - | C57BL/6J | regular | 18.10.2006 | Charles River | - | | | monika | no import comment |
| 5 | import 55 | "" | 9 | - | ABC-G640C | regular | 08.08.2006 | Charles River | - | | | monika | no import comment |
| 6 | import 54 | "" | 6 | - | C57BL/6J | regular | 31.07.2006 | Charles River | - | | | monika | no import comment |
| 7 | import 53 | "" | 2 | - | Foster | regular | 28.02.2006 | Charles River | - | | | monika | no import comment |
| 8 | import 52 | "" | 2 | - | ABC-FLP-CON | regular | 13.03.2006 | Charles River | - | | | monika | no import comment |
| 9 | import 51 | "" | 6 | - | ABC-C3H | regular | 07.03.2006 | Charles River | - | | | admin | no import comment |
| 10 | import 50 | "" | 2 | - | ABC-129 | regular | 30.08.2005 | Charles River | - | | | admin | no import comment |
| 11 | import 49 | "" | 1 | - | ABC-129 | regular | 20.12.2005 | Charles River | - | | | admin | no import comment |
| 12 | import 48 | "" | 2 | - | C57BL/6J | regular | 15.02.2006 | Charles River | - | | | monika | no import comment |
| 13 | import 47 | "" | 2 | - | C57BL/6J | regular | 02.08.2005 | Charles River | - | | | monika | no import comment |
| 14 | import 46 | "" | 2 | - | HIJ-B-B6 | regular | 01.10.2005 | Charles River | - | | | admin | no import comment |
| 15 | import 45 | "" | 2 | - | FLP-B6 | regular | 05.01.2006 | Charles River | - | | | admin | no import comment |
| 16 | import 44 | "" | 27 | - | C57BL/6J | regular | 15.03.2005 | Charles River | - | | | admin | no import comment |
| 17 | import 43 | "" | 2 | - | ABC-CON | regular | 15.03.2005 | Charles River | - | | | admin | no import comment |
| 18 | import 42 | "" | 2 | - | C57BL/6J | regular | 14.01.2005 | Charles River | - | | | admin | no import comment |
| 19 | import 41 | "" | 1 | - | HIJ-C-B6 | regular | 14.02.2005 | Charles River | - | | | admin | no import comment |
| 20 | import 40 | "" | 6 | - | ABE-C3H | regular | 01.02.2005 | Charles River | - | | | admin | no import comment |
| 21 | import 39 | "" | 3 | - | HIJ-B-B6 | regular | 14.06.2005 | Charles River | - | | | admin | no import comment |
| 22 | import 38 | "" | 4 | - | C3HeB/FeJ | regular | 01.04.2005 | Charles River | - | | | admin | no import comment |
| 23 | import 37 | "" | 3 | - | GHI-B6 | regular | 04.12.2005 | Charles River | - | | | admin | no import comment |
| 24 | import 36 | "" | 8 | - | C57BL/6J | regular | 01.07.2005 | Charles River | - | | | admin | no import comment |
| 25 | import 35 | "" | 2 | - | HIJ-A-B6 | regular | 01.02.2006 | Charles River | - | | | admin | no import comment |

**Figure 28: Import overview. All imports are shown. Multiple result pages can be browsed using the „first“, „previous“, „next“, and „last“ links. Clickable import IDs lead to the detailed import view of the individual import.**

## 4.9 Managing your phenotyping data – Parametersets

Phenotyping data is organized in pre-definable "**Parameters**" within MausDB. Sets of parameters that result from an assay can be grouped/organized in so-called "**Parametersets**". These can be viewed and defined via the user interface (***reports → parameters, reports → parametersets***).

Example parameters and parametersets can be generated using the script "parametersets.sql" that is part of the download repository (\\ means: into same line):

```
# mysql –u <user> –p<password> mausdb       <     \\
/home/admin/mausdb/SQL/setup_database/parameters.sql
```

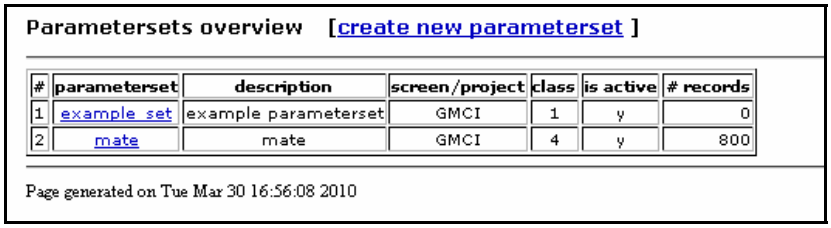



**Figure 29: Parametersets overview. Two example parametersets are shown.**

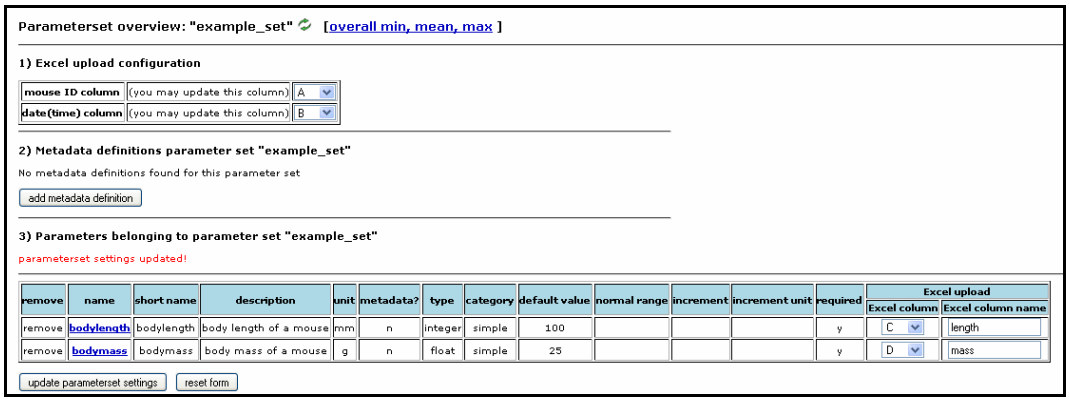



**Figure 30: Parameterset overview. Two parameters are defined, columns for Excel upload interface are set up and can be configured via the web user interface.**

## 4.10 Scheduling phenotyping assays and common tasks

In MausDB, routine common tasks (mate, wean, ship mice, sperm freeze) as well as phenotyping assays can be scheduled by scientists or a core team using the so-called "**orderlists**".

An orderlist basically is a list of mice scheduled for a particular task (formally called a "parameterset") with a particular due date.

A so-called "**workflow**" is a series of "**parametersets**" (tasks) ordered in a given temporal order. This way, standard multi-step routines like primary phenotyping or cryo-preservation workflows can be assigned to groups of mice in one step resulting in a number of orderlists. Worklists currently have to be defined on SQL level. Example scripts are available in the download repository.

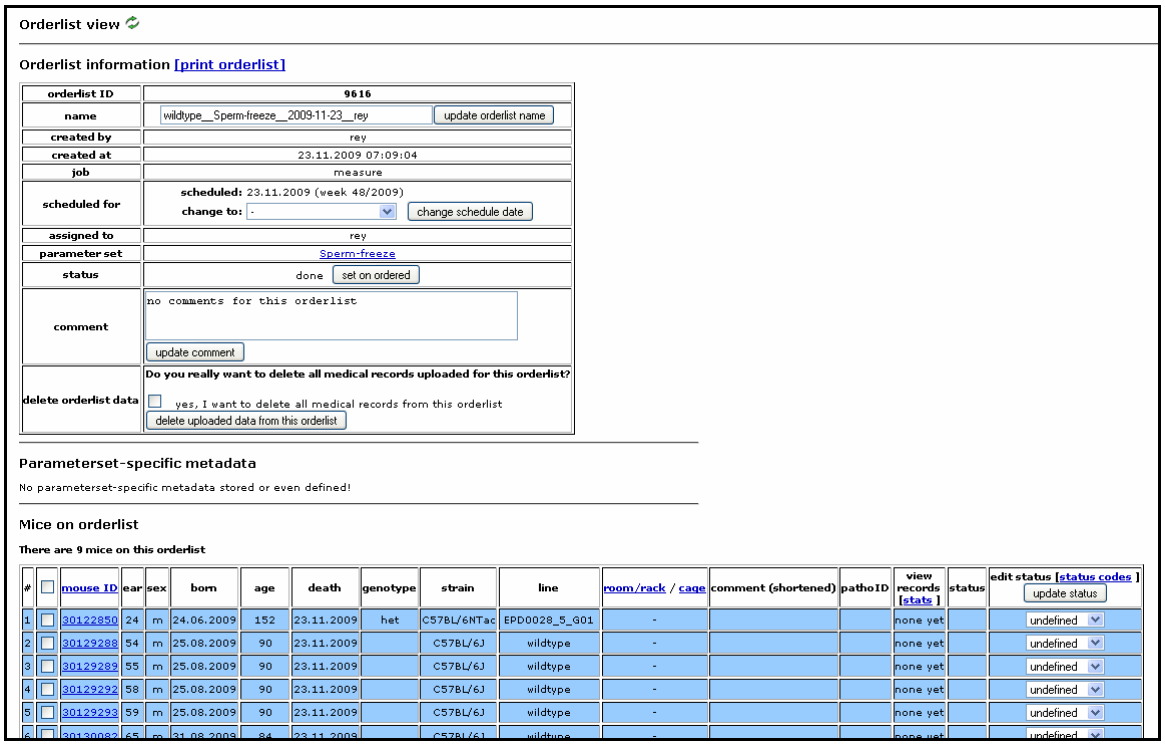



**Figure 31: Orderlist view. A list of 9 mice is scheduled for sperm freezing for a specific date.**

In order to generate an orderlist or a series of orderlists, start from the cart, select your mice and choose **order phenotyping**.

In the next step, either choose a user-defined workflow or a previous defined workflow.

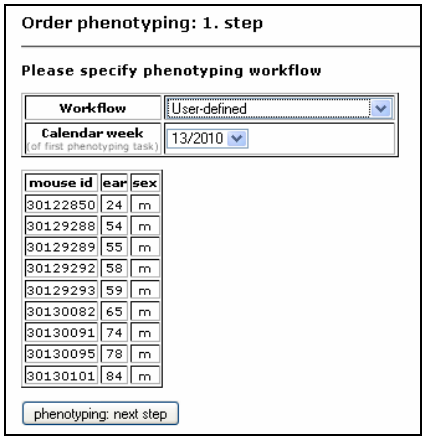



**Figure 32: Order phenotyping, 1. step. Choose a workflow for selected mice**

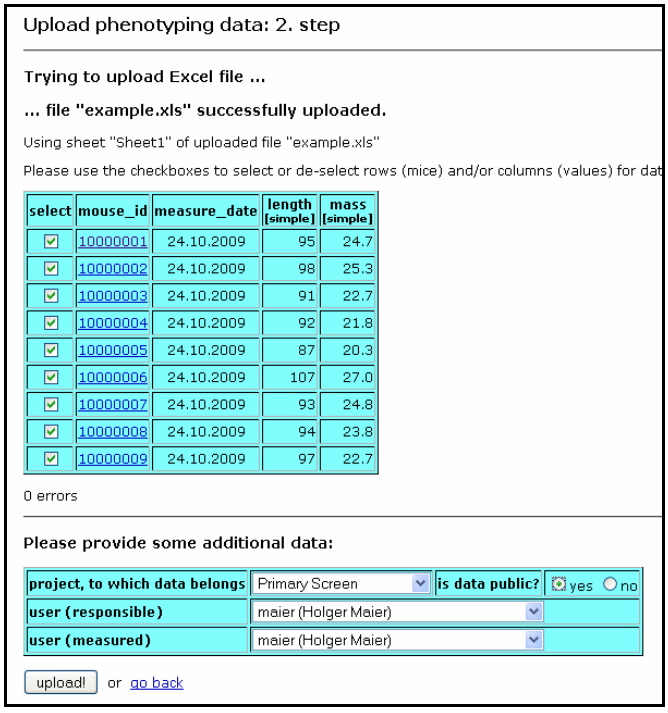
In the next step, specify tasks/parametersets and their corresponding due dates. Finally, confirm your order which will result in the generation of orderlists. The orderlists will be displayed on the "**Home**" page of MausDB.

## *4.11 Loading phenotype data into MausDB*

Parametric phenotype data can be uploaded into MausDB using Excel sheets. For every parameterset, columns can be defined interactively via the web interface (see above). Once defined, data can be uploaded from Excel files starting from a specific orderlist (select mice

from orderlist, then press button "**upload data for mice from this list**"). In the next step, the file has to be located on your file system and the the sheet can be chosen.

Upon upload, mouse ids from the orderlist and from the specified column in the Excel file are matched. An example Excel file (**home/admin/mausdb/info/example.xls**) is available in the download repository. In order to be able to use this example, mice with corresponding mouse ids must exist in the database and be part of an "example set" orderlist. You may also adjust mouse ids and dates (of measurement) in the Excel file (columns A and B).


Upload phenotyping data: 2. step

Trying to upload Excel file ...

... file "example.xls" successfully uploaded.

Using sheet "Sheet1" of uploaded file "example.xls"

Please use the checkboxes to select or de-select rows (mice) and/or columns (values) for dat

| select | mouse_id | measure_date | length [simple] | mass [simple] |
|---|---|---|---|---|
| ☑ | 10000001 | 24.10.2009 | 95 | 24.7 |
| ☑ | 10000002 | 24.10.2009 | 98 | 25.3 |
| ☑ | 10000003 | 24.10.2009 | 91 | 22.7 |
| ☑ | 10000004 | 24.10.2009 | 92 | 21.8 |
| ☑ | 10000005 | 24.10.2009 | 87 | 20.3 |
| ☑ | 10000006 | 24.10.2009 | 107 | 27.0 |
| ☑ | 10000007 | 24.10.2009 | 93 | 24.8 |
| ☑ | 10000008 | 24.10.2009 | 94 | 23.8 |
| ☑ | 10000009 | 24.10.2009 | 97 | 22.7 |

0 errors

Please provide some additional data:

| project, to which data belongs | Primary Screen | is data public? | yes no |
|---|---|---|---|
| user (responsible) | maier (Holger Maier) | | |
| user (measured) | maier (Holger Maier) | | |

upload! or go back

**Figure 33: Uploading phenotype data. Data is matched via mouse id columns in orderlist and Excel file.**

## 4.12 Statistics and visualisation of phenotyping data using the R interface

Phenotyping data stored in MausDB can be visualised and statiscally analysed using the custom R interface of MausDB. Three steps are necessary and are shown on an example (\\ means: into same line):

### a) a specific SQL script needs to be located in /var/www/mausdb/R

```
# sudo cp /home/admin/mausdb/code/var/www/mausdb/R/example.sql   \\
/var/www/mausdb/R
```

### b) a specific R script also needs to be located in /var/www/mausdb/R

```
# sudo cp /home/admin/mausdb/code/var/www/mausdb/R/example.r     \\
/var/www/mausdb/R
```

### c) the two scripts need to be "known" by MausDB (\\ means: into same line):

```
# mysql –u <user> –p<password> mausdb       <                    \\
/home/admin/mausdb/SQL/insert/add_settings_R_scripts.sql
```

The entry made here must be the prefix name of the two scripts. In this example, “example.r” and “example.sql” require adding “example” to table settings.

Please study the example.r and example.sql for further explanations how the system is working.

In order to run the script, go to the orderlist and press the button “**apply R script**”.

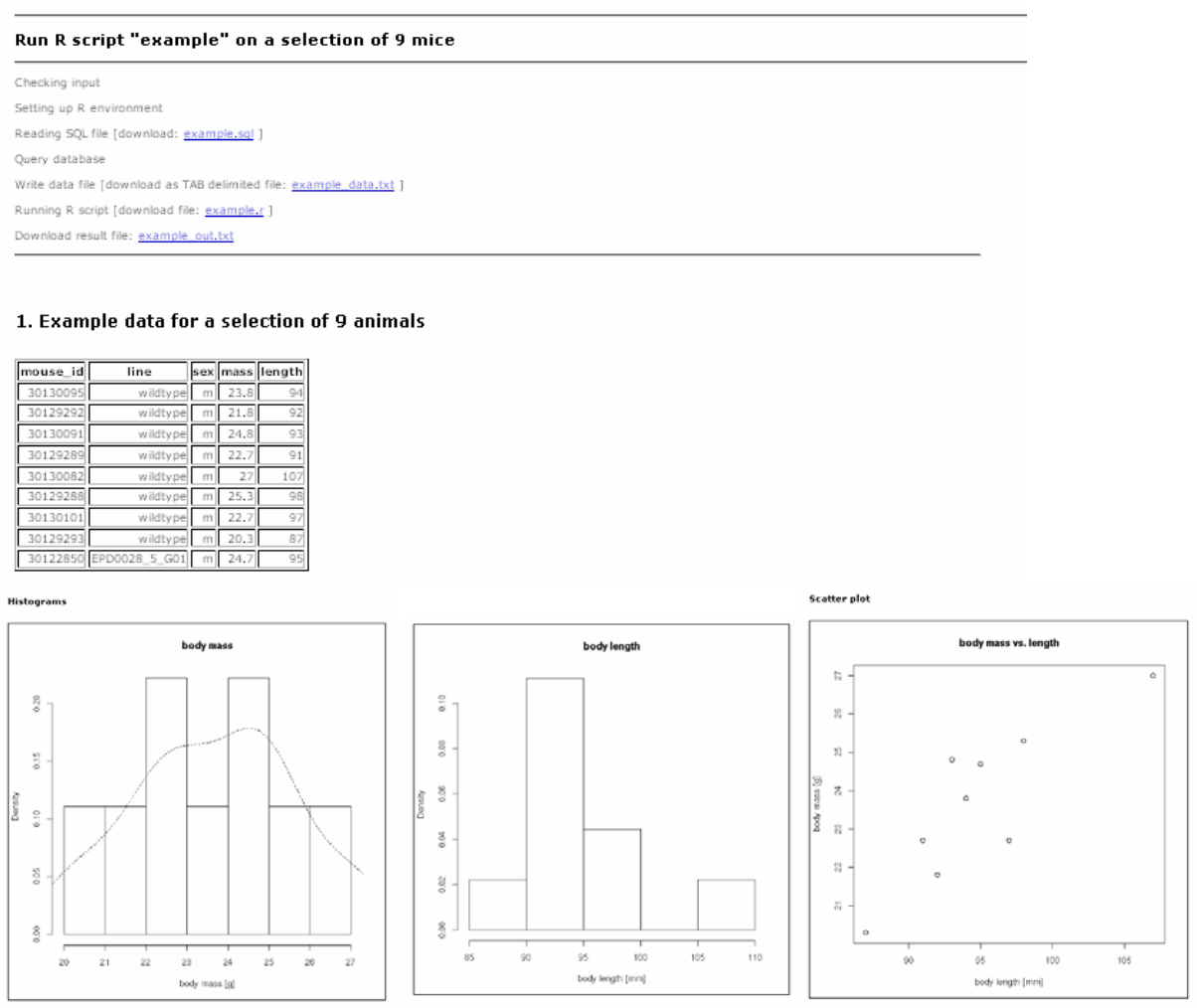



**Figure 34: Example of phenotype data visualisation using R scripts via the MausDB web interface. Please note: data has been generated randomly and must not make sense at all.**

## 4.13 Overviews and reports – the “reports” page

### 4.13.1 Mouse lines overview

In order to get an overview about all mouse lines in MausDB, choose ***reports → line overview***.

Mouse lines overview

28 mouse lines found

**Browse pages:** [first] [previous] [next] [last]

| # | line name (short) | line name (long) | alive (click on numbers to generate Excel report) | | |
|---|---|---|---|---|---|
| | | | males | females | total |
| 1 | ABC-129 | ABC-129 | 24 | 31 | 55 |
| 2 | ABC-A-CON | ABC-A-CON | 0 | 0 | 0 |
| 3 | ABC-B-CON | ABC-B-CON | 26 | 23 | 49 |
| 4 | ABC-C-CON | ABC-C-CON | 0 | 0 | 0 |
| 5 | ABC-C3H | ABC-C3H | 34 | 42 | 76 |
| 6 | ABC-CON | ABC-CON | 0 | 0 | 0 |
| 7 | ABC-FLP-CON | ABC-FLP-CON | 41 | 39 | 80 |
| 8 | ABC-G640C | ABC-G640C | 36 | 50 | 86 |
| 9 | ABC-G640CxABC-C3H | ABC-G640CxABC-C3H | 0 | 0 | 0 |
| 10 | ABCxBCD-129 | ABCxBCD-129 | 0 | 0 | 0 |
| 11 | ABE-C3H | ABE-C3H | 22 | 35 | 57 |
| 12 | BCDxABC-129 | BCDxABC-129 | 0 | 0 | 0 |
| 13 | C3HeB/FeJ | C3HeB/FeJ | 23 | 25 | 48 |
| 14 | C57BL/6J | C57BL/6J | 9 | 18 | 27 |
| 15 | FLP-B6 | FLP-B6 | 8 | 10 | 18 |
| 16 | Foster | Foster | 0 | 0 | 0 |
| 17 | GHI-B | GHI-B | 0 | 0 | 0 |
| 18 | GHI-B6 | GHI-B6 | 47 | 31 | 78 |
| 19 | HIJ-A-B6 | HIJ-A-B6 | 10 | 13 | 23 |
| 20 | HIJ-B-B6 | HIJ-B-B6 | 17 | 23 | 40 |
| 21 | HIJ-C-B6 | HIJ-C-B6 | 5 | 0 | 5 |
| 22 | HIJ-DEF-ABC-129 | HIJ-DEF-ABC-129 | 45 | 51 | 96 |
| 23 | HIJ-DEF-B6 | HIJ-DEF-B6 | 0 | 0 | 0 |
| 24 | KLM-CKO | KLM-CKO | 0 | 0 | 0 |
| 25 | KLM-KO | KLM-KO | 5 | 2 | 7 |

**Figure 35: Mouse lines overview. All mouse lines are listed alphabetically. Multiple result pages can be browsed using the navigation links on top of the table. Clickable line names lead to line specific detail views. Clickable numbers show current live stock of male, female or total mice per line.**

### 4.13.2 Mouse strains (genetic backgrounds) overview

In order to get an overview about all mouse strains (genetic backgrounds) in MausDB, choose ***reports → strain overview***.

Mouse strains overview

4 mouse strains found

| # | strain name | alive | | |
|---|---|---|---|---|
| | | males | females | total |
| 1 | - | 349 | 393 | 742 |
| 2 | BTNT | 5 | 2 | 7 |
| 3 | C57BL/6J | 6 | 5 | 11 |
| 4 | C57BL/6J-BTNT | 0 | 0 | 0 |
| total living mice (all strains) | | 360 | 400 | 760 |

**Figure 36: Mouse strains overview. Multiple result pages can be browsed using the navigation links on top of the table. Clickable strain names lead to strain specific detail views.**

### 4.13.3 [Specific to Helmholtz Zentrum München[6]: TEP report]

TEP is the German acronym for an animal registration program. The TEP system was developed on behalf of the Helmholtz Zentrum München and is now licensed for use by Ascenion (www.ascenion.de) for the quantitative registration of laboratory animals of different species in an animal facility. The TEP report module in MausDB provides an export of statistical information that can be used for import into the Helmholtz Zentrum München TEP system.

The TEP report function produces a file in spreadsheet format (.xls). It contains a matrix with columns representing different reasons for assigning a MausDB mouse ID (import/weaning), death reasons or different states a mouse can have (breeding or experiment). In the rows the numbers of animals are listed which belong to the corresponding category grouped by a calendar week and TEP key (genetically modified yes/no, breeding or experimental name).

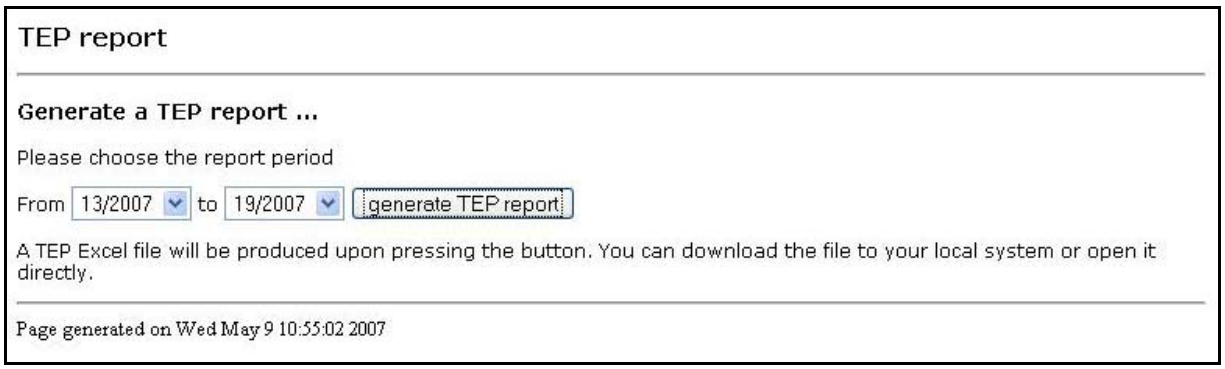



**Figure 37: TEP report. The report time period must be selected on calendar week level. An Excel file will be produced which can be imported into the Helmholtz Zentrum München TEP system.**

### 4.13.4 [Specific to Helmholtz Zentrum München: Versuchstiermeldung]

The "Versuchstiermeldung" (German expression for laboratory animal report) produces another set of statistical information. For all months of a given year, the number of animals which were newly assigned to a given experiment is calculated.

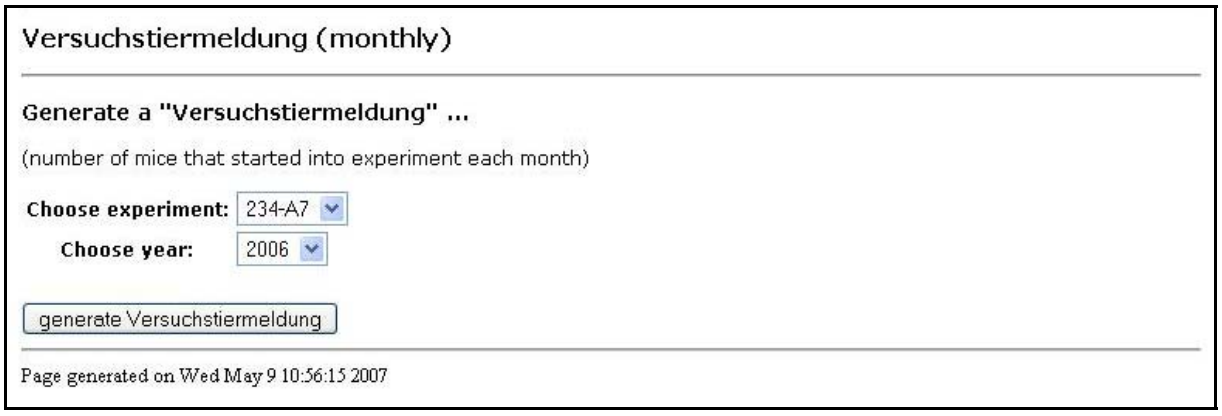



**Figure 38: Versuchstiermeldung. For a given year, the number of animals used every month in the course of a given experiment is calculated.**

[6] Helmholtz Zentrum München, German Research Center for Environmental Health, Ingolstädter Landstr. 1, D-85764 Neuherberg, Germany

### 4.13.5 Snapshot tail count

The number of animals housed in a given area at a given point in time can be determined using the “snapshot tail count” function.

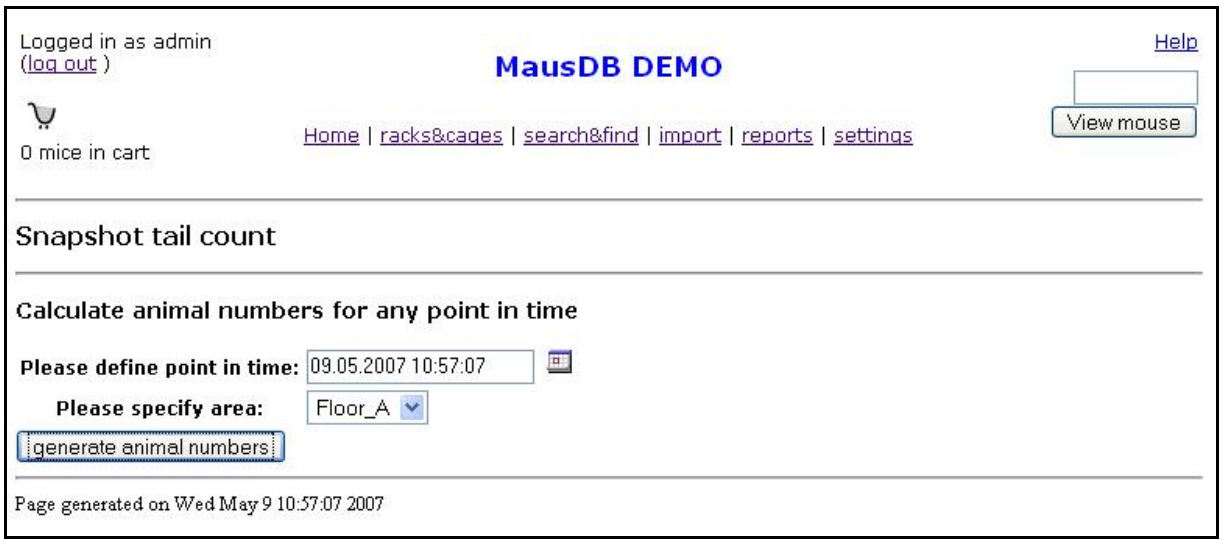



**Figure 39: Snapshot tail count. A point in time and an area can be chosen. The number of animals will be calculated within a few seconds.**

### 4.13.6 Cage occupation

The number of “mouse days” in a given time period and area can be determined using the “cape occupation” function. One “mouse day” is the equivalent of one mouse being housed one day and can be used for cost billing purposes, for example.

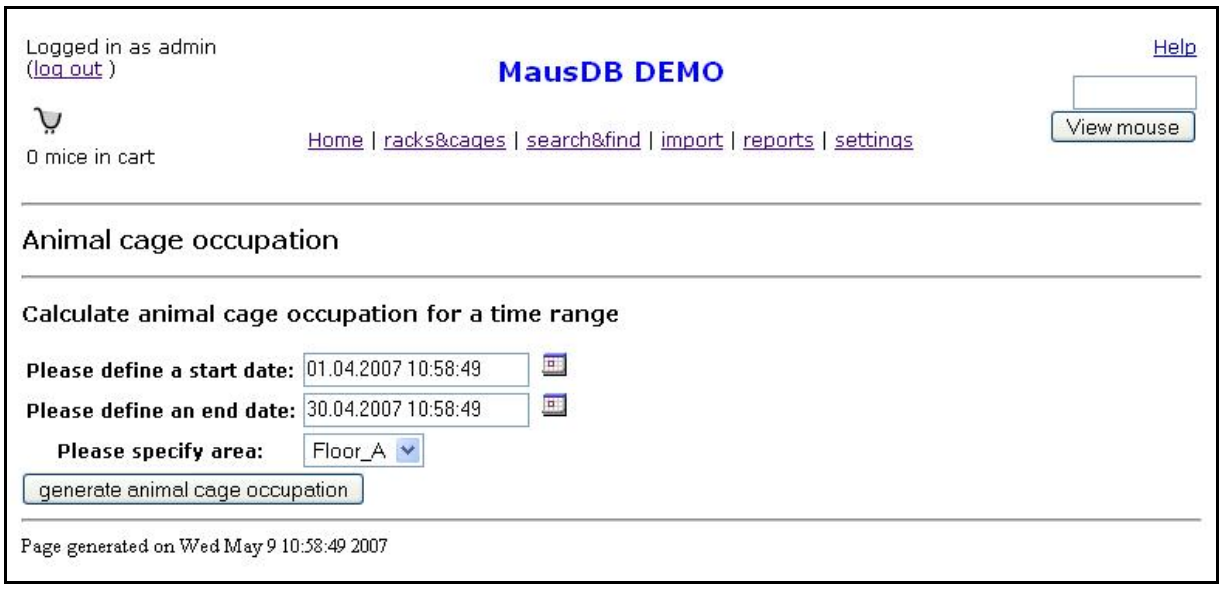



**Figure 40: Cage occupation. A time period and an area can be chosen. The number of „mouse days“ will be calculated within short time.**

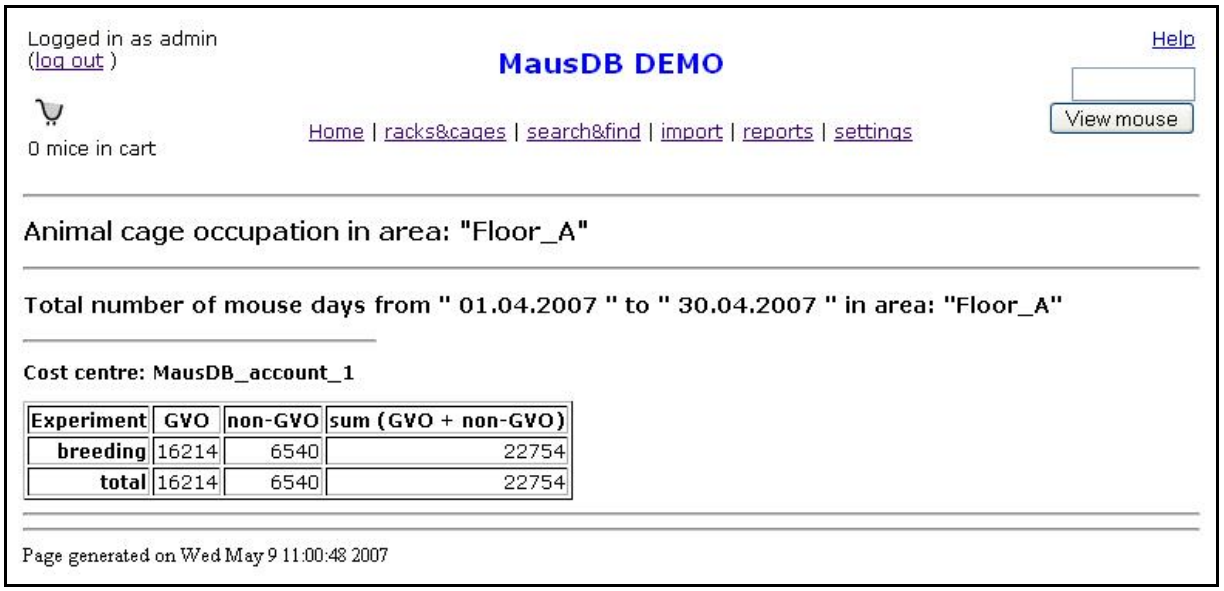



**Figure 41: Result of cage occupation calculation. For a given time period and area, „mouse days“ are calculated. Numbers are calculated separately for genetically modified (GVO) and genetically non-modified mice (non-GVO).**

# 5 Detailed step-by-step instructions for common tasks

## 5.1 How to set up a mating

The origin concept of mice in MausDB strictly requires a mating to happen before offspring can be weaned. It is important to stress that in MausDB, a mating is defined on an abstract level as the possibility that one male mouse and at least one female mouse can mate and produce offspring. As soon as such a mating is defined, litter can be reported and weaned. Litter reporting is a precondition for weaning.

**Important**: The mating is not at all coupled to co-caging (during a mating the mating partners do not necessarily have to be housed in the same cage), i.e. there is no automatic mating, when males and females are moved into the same cage. On the other hand, once a mating is defined, it will not be stopped automatically upon separation of the animals.

### 5.1.1 Step 1: Defining mating partners

In order to define the mating partners (one male, one or more females), these must be selected first either in the rack view (see 4.4.2) or after having collected them in the cart (see 4.5).

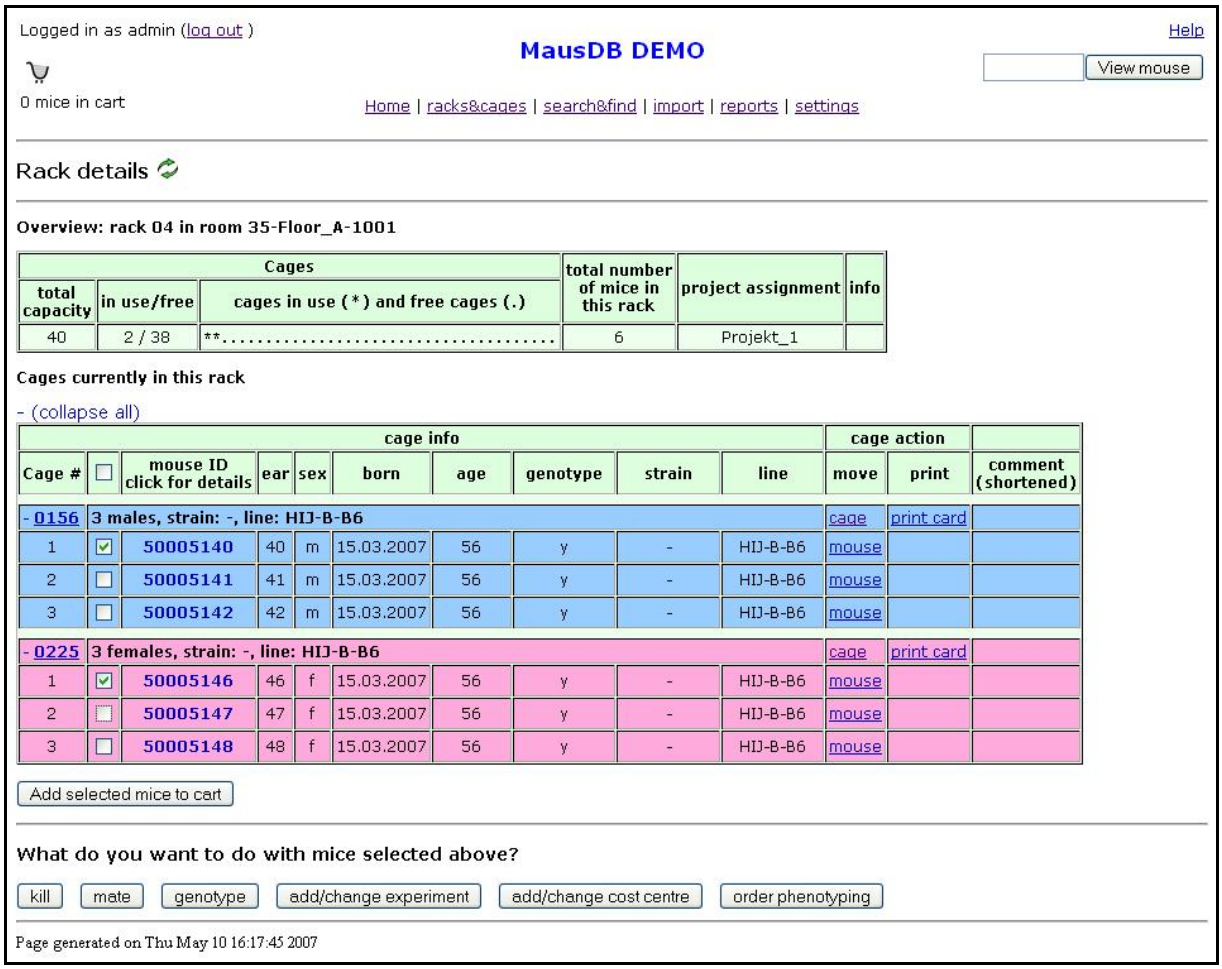



**Figure 42: Step 1: Defining mating partners. In the expanded rack view (see 4.4.2), mating partners are selected by checking the box in the first column. The „mate“ button on the page bottom directly leads to step 2. Alternatively, selected mice can be put in the cart, where the „mate“ button is also available.**

### 5.1.2 Step 2: Defining mating details

In the second step of the mating procedure, mating details need to be defined by the user. In addition, mating partners are checked automatically if they are qualified for mating (are they still alive? One male, at least one female? Minimum age of xx days?).

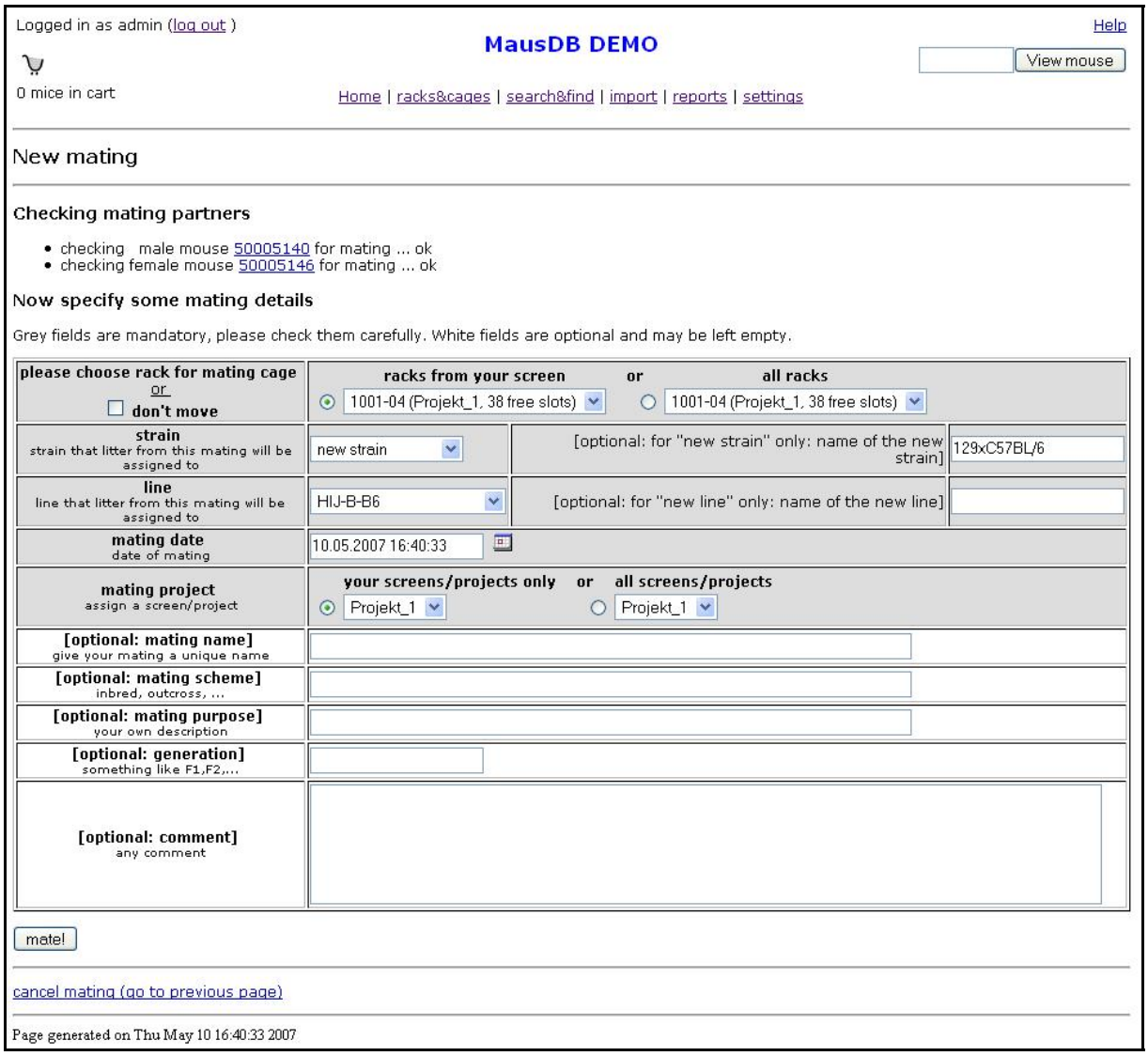



**Figure 43: Step 2: Defining mating details. Per default, a mating is automatically set up in a new cage where mice are put together. As a consequence, the user can choose the rack in the first table row. Alternatively, checking the „don't move" box will cause MausDB to leave mating partners where they are. Strain (genetic background) of mating offspring needs to be chosen in the second table row from a pulldown menu. Alternatively, a new strain can be defined by choosing „new strain" in the pulldown menu and entering a new strain in the input field. The same procedures applies for mouse line selection in the third table row. Mating date refers to the date when the mating really started. Defining a mating project will remember project assigned users about litter weaning. Other fields can be optionally filled by users. Pressing the „mate!" button will finally set up the mating and present a confirmation page (see below).**

### 5.1.3 Step 3: Confirmation

If the mating could be successfully set up in the database, a confirmation page is displayed.

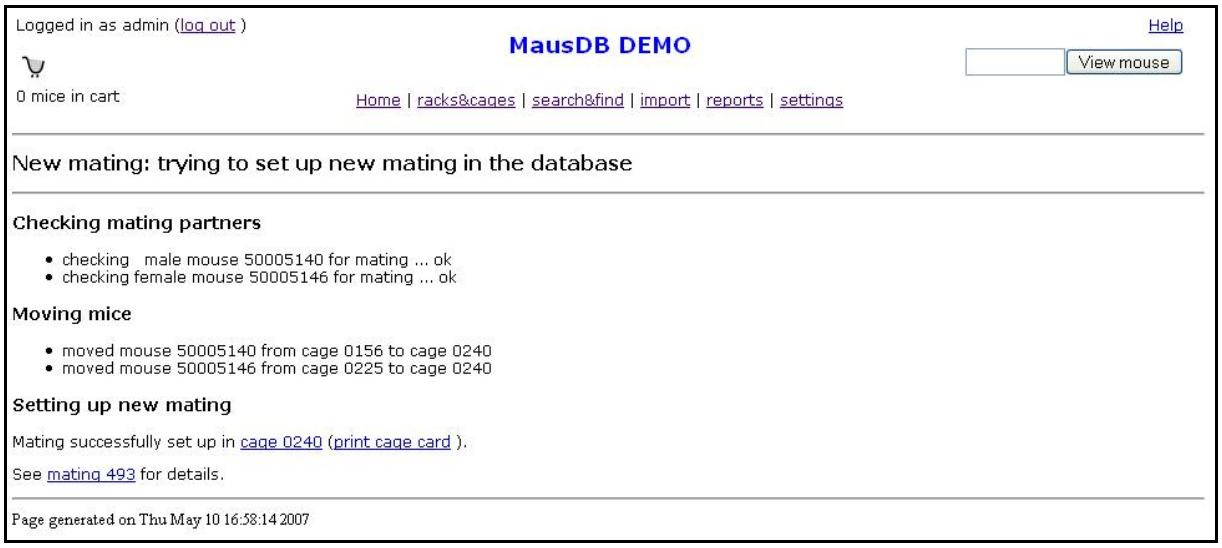



**Figure 44: Step 3: Confirmation. Clickable links for mating ID and mating cage are displayed.**

## 5.2 How to set up an embryo transfer

In MausDB, an embryo transfer essentially is a special case of a mating. In a normal mating, both mating partners are already managed by MausDB and thus have a mouse ID.

In an embryo transfer, the real mating event may have taken place even long time ago outside the facility that is managed by MausDB if frozen embryos are used. The MausDB embryo transfer procedure records the event of implanting an embryo of whatever origin to a recipient female mouse. As soon as this is done, an equivalent to a normal mating is defined and subsequently litters can be reported and weaned.

Embryo transfers only can be started from the cart. Another difference to setting up a normal mating is that the biological father can be optionally defined if available as a MausDB mouse or left out if it is an external mouse. The recipient female mouse must have a mouse ID, i.e. be defined in MausDB.

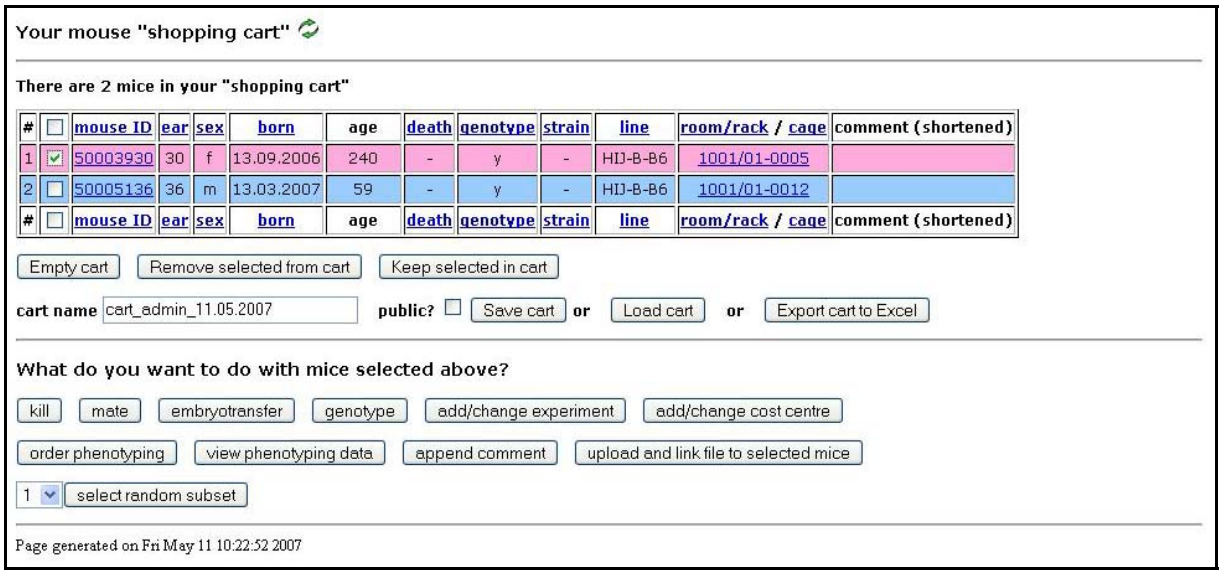



**Figure 45: Step 1: Select a female embryo recipient mouse in the cart. Optionally also select the biological father mouse (sperm donor) if available in MausDB. Start embryo transfer procedure by clicking the „embro ytransfer“ button in the bottom task bar.**

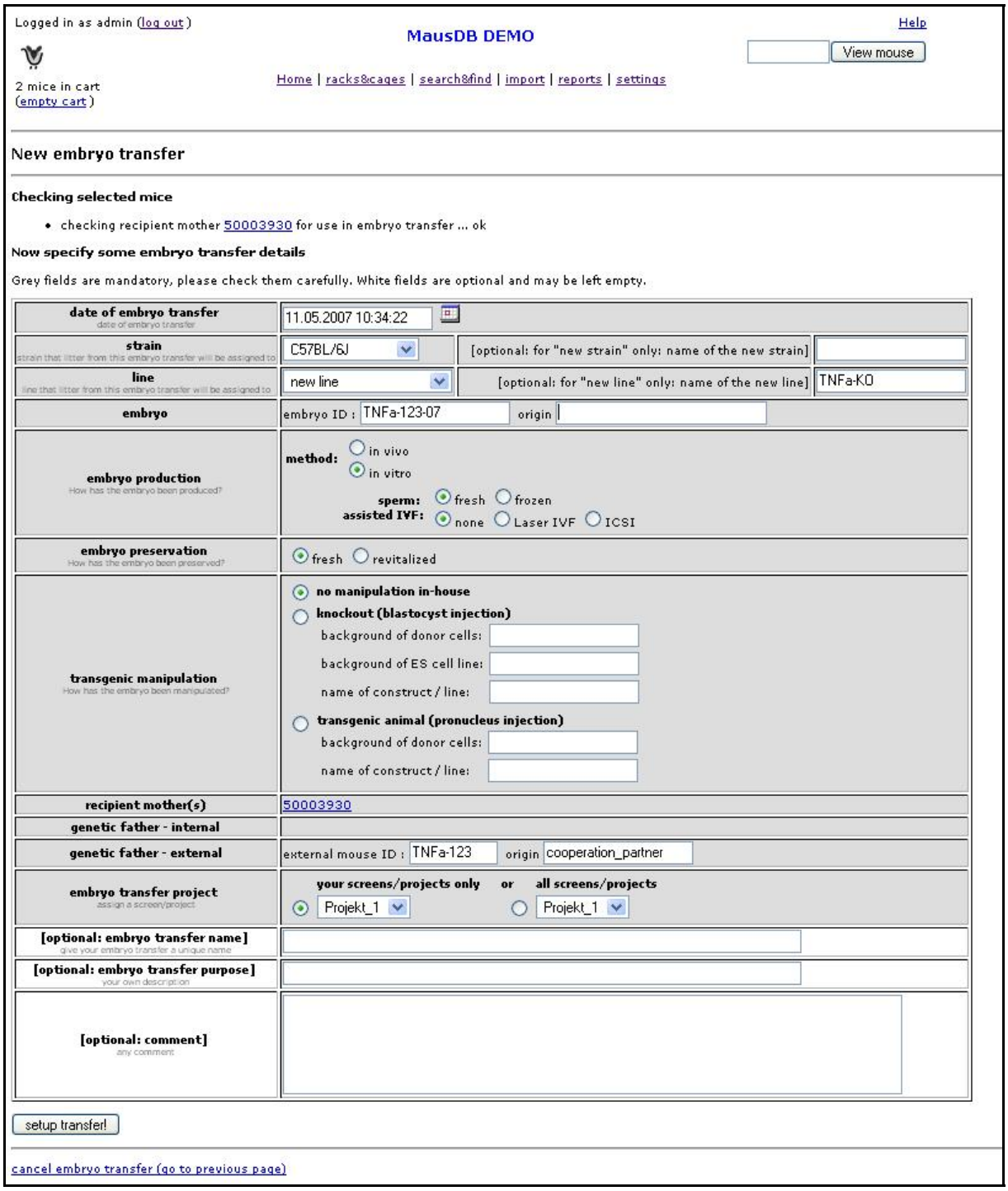



**Figure 46: Step 2: Defining embryo transfer details. Embryo transfer date refers to the date when the embryo really was implanted. Strain (genetic background) of mating offspring needs to be chosen in the second table row from a pulldown menu. Alternatively, a new strain can be defined by choosing „new strain“ in the pulldown menu and entering a new strain in the input field. The same procedures applies for mouse line selection in the third table row. In the following rows, additional embryo transfer information can be given. Defining a project will remember project assigned users about litter weaning. Other fields can be optionally filled by users. Pressing the „setup transfer!“ button will finally set up the embryo transfer and present a confirmation page (see below).**

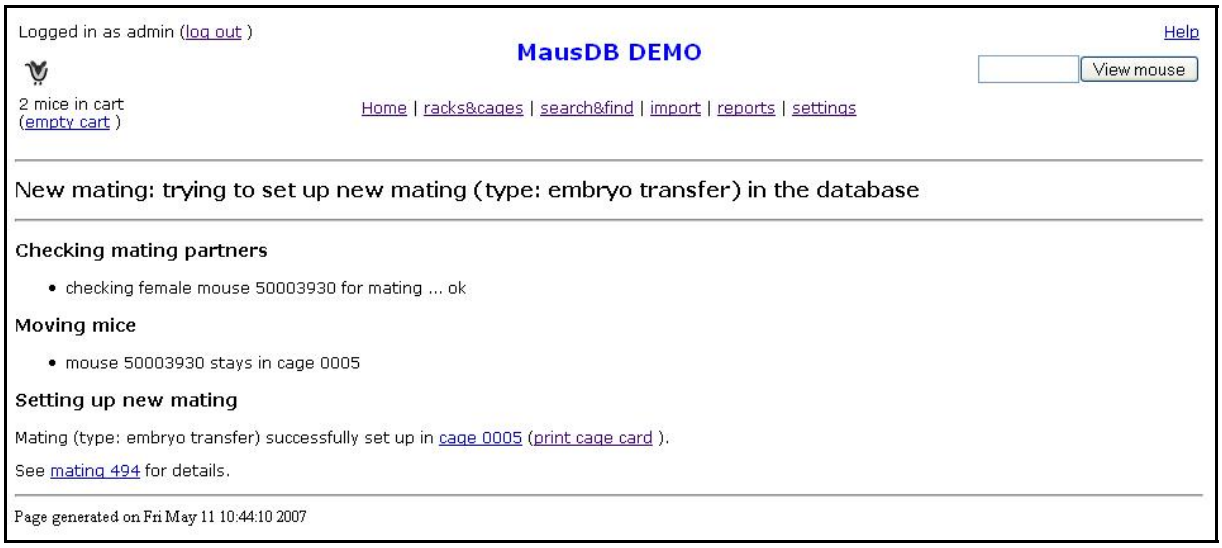



**Figure 47: Step 3: Confirmation. Clickable links for mating ID and mating cage are displayed.**

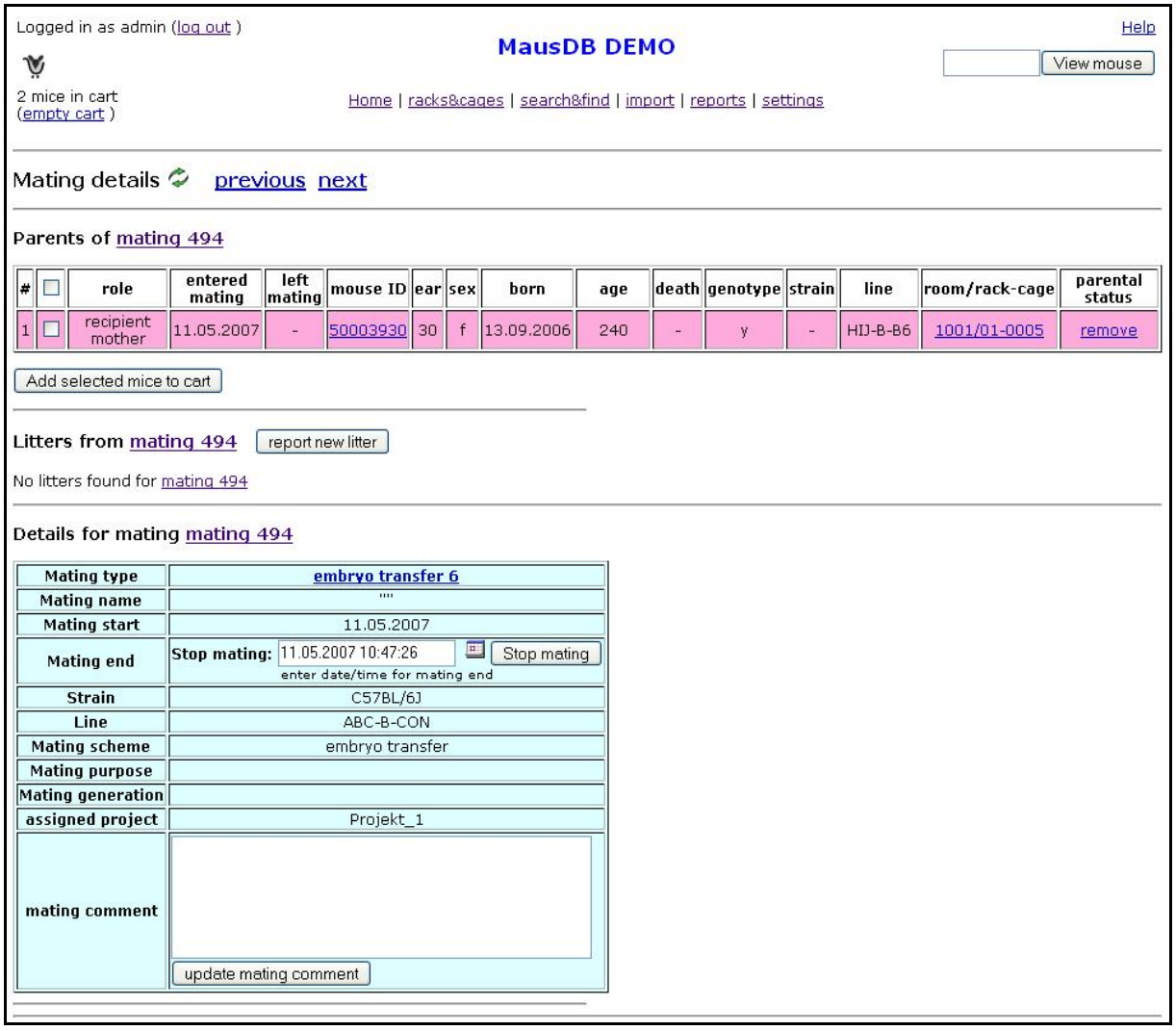



**Figure 48: Mating details view for an embryo transfer. The first row of the second table (Mating type) contains a clickable link that leads to an embryo transfer specific view (see below).**

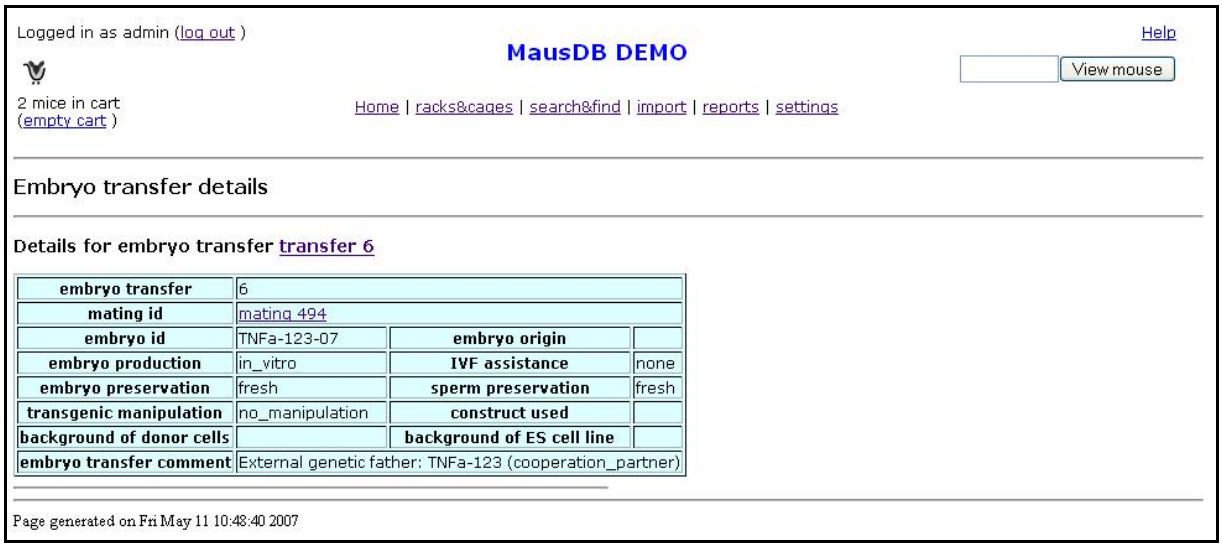



**Figure 49: Embryo transfer details view.**

## 5.3 How to report litter

As soon as newborns are observed, they can be reported to the database. Litter reporting is a precondition for weaning in MausDB. Litter reporting always starts from the mating details page of the mating where litter has to be reported.

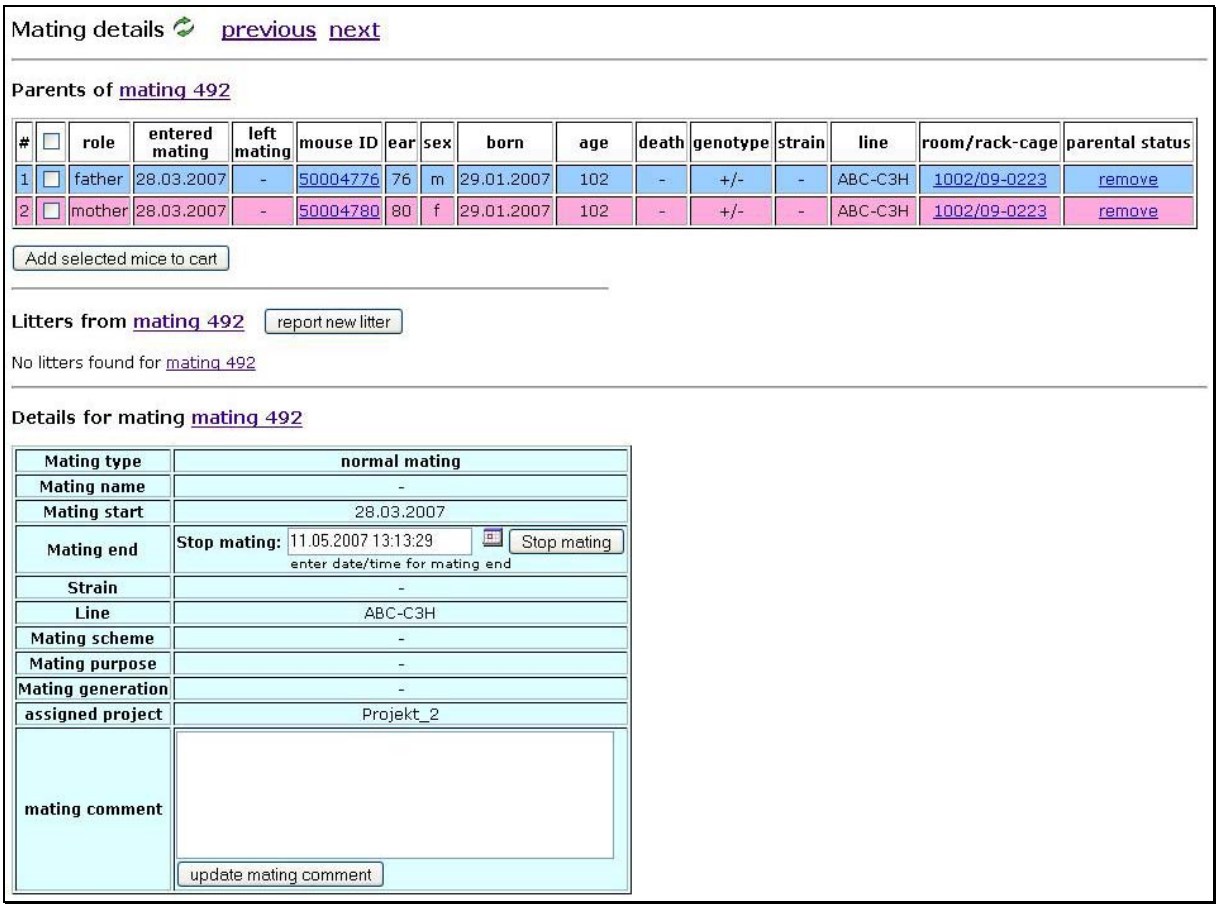



**Figure 50: Step 1: Report litter for the correct mating. Between parents table and mating details box, the button „report new litter“ can be used to report litter for the current mating.**

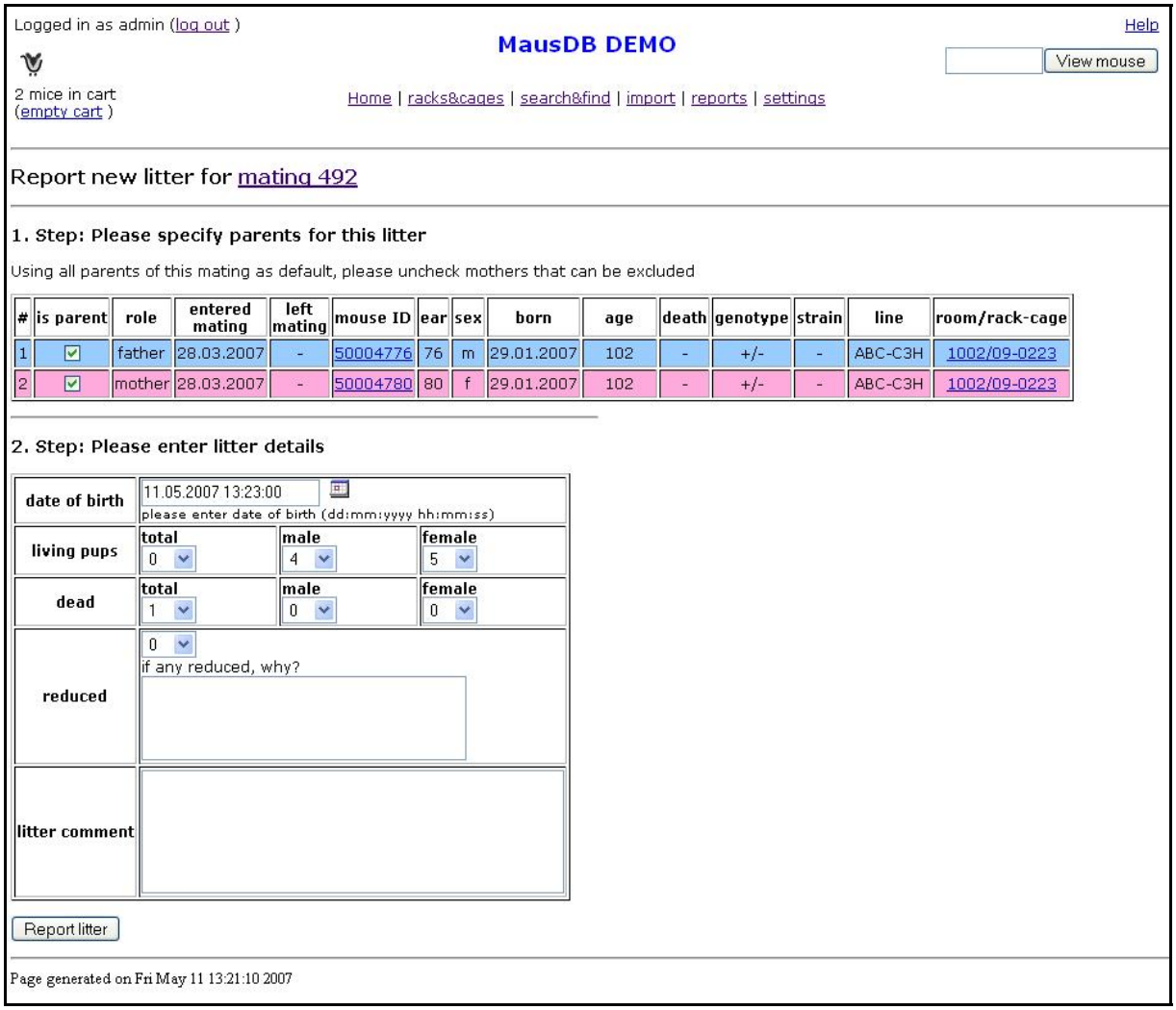



**Figure 51: Step 2: Specifying litter details. In the upper table, parents have to be assigned to the litter. If, for example, a double mating (one male, two females) has been setup and there is clear evidence for one female being the mother of newborns, the other female mouse can be unchecked to state it is not the mother. In the second box, date of birth has to be entered. Numbers for observed newborns as well as a litter comment can be entered below. Litter report is finished by pressing „Report litter".**

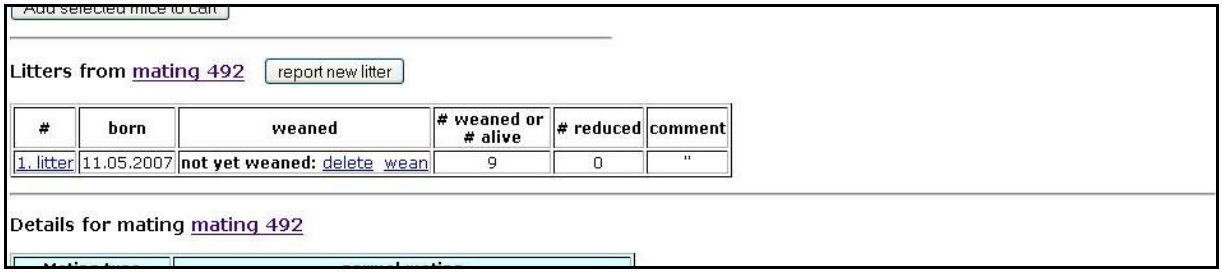



**Figure 52: Step 3: Confirmation. After pressing „Report litter", the litter has been added to the litters table in the current mating view. Clicking on the litter (column 1) will lead to the litter details page (see 4.7.5). Using the links in the third column, the litter can be deleted or weaned, respectively.**

## 5.4 How to wean litter or report litter loss

As soon litter has been reported to MausDB, it can be weaned. The weaning procedure either starts from the litters table in the mating view (see Figure 52) or from the litters table in the Home area (see Figure 10). In either case, a click on the weaning link will start the weaning dialog.

The weaning procedure in MausDB includes the generation of mouse IDs for all weaned mice, eartag assignment and rack/cage allocation of these mice.

In the following example, a litter with 3 males is weaned:

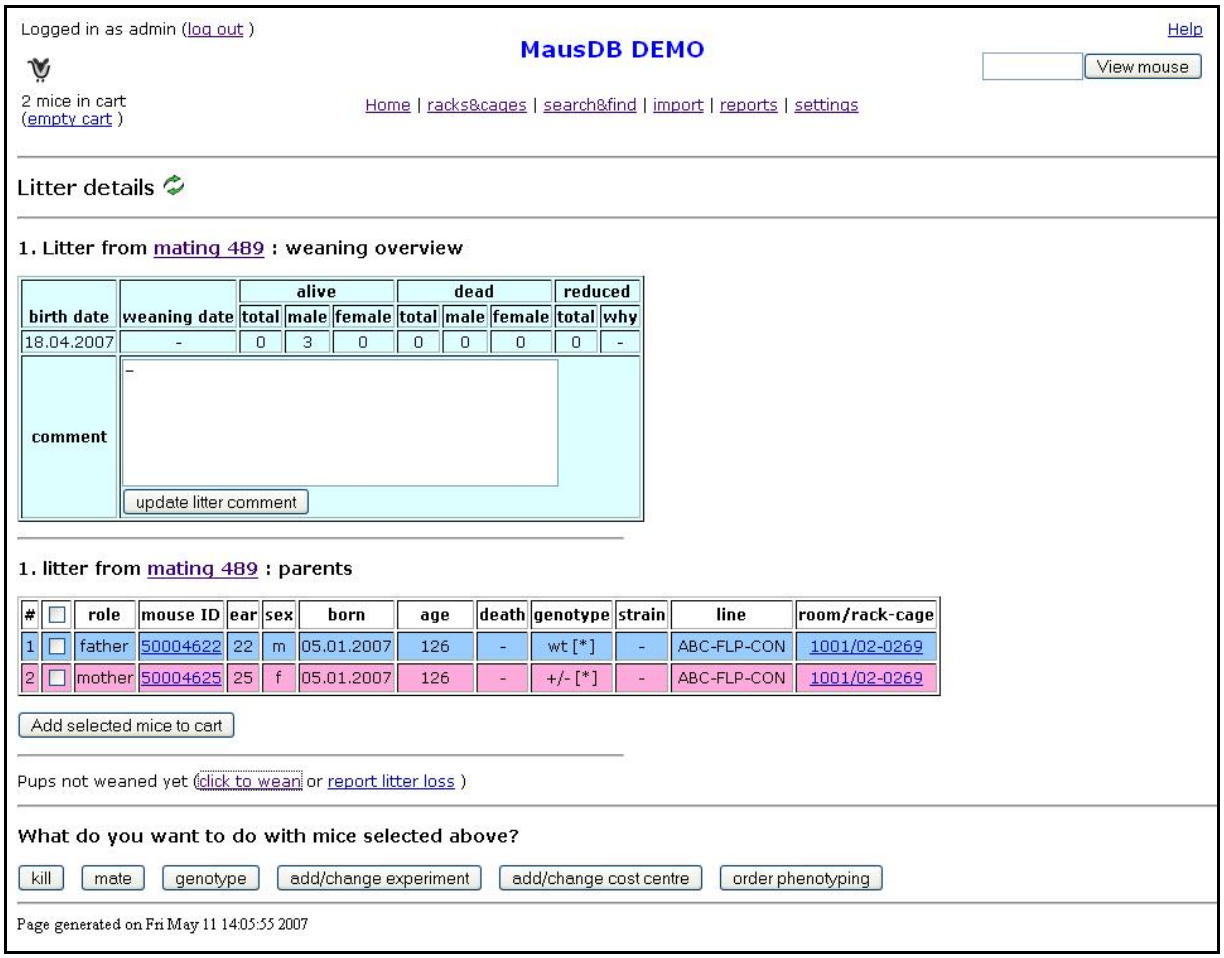



**Figure 53: Step 1: Starting the weaning dialog from the litter details view (see 4.7.5). An already reported litter can be weaned by following the „click to wean“ link on the bottom. Alternatively, if pubs are gone, this can be reported by following the „report litter loss“ link.**

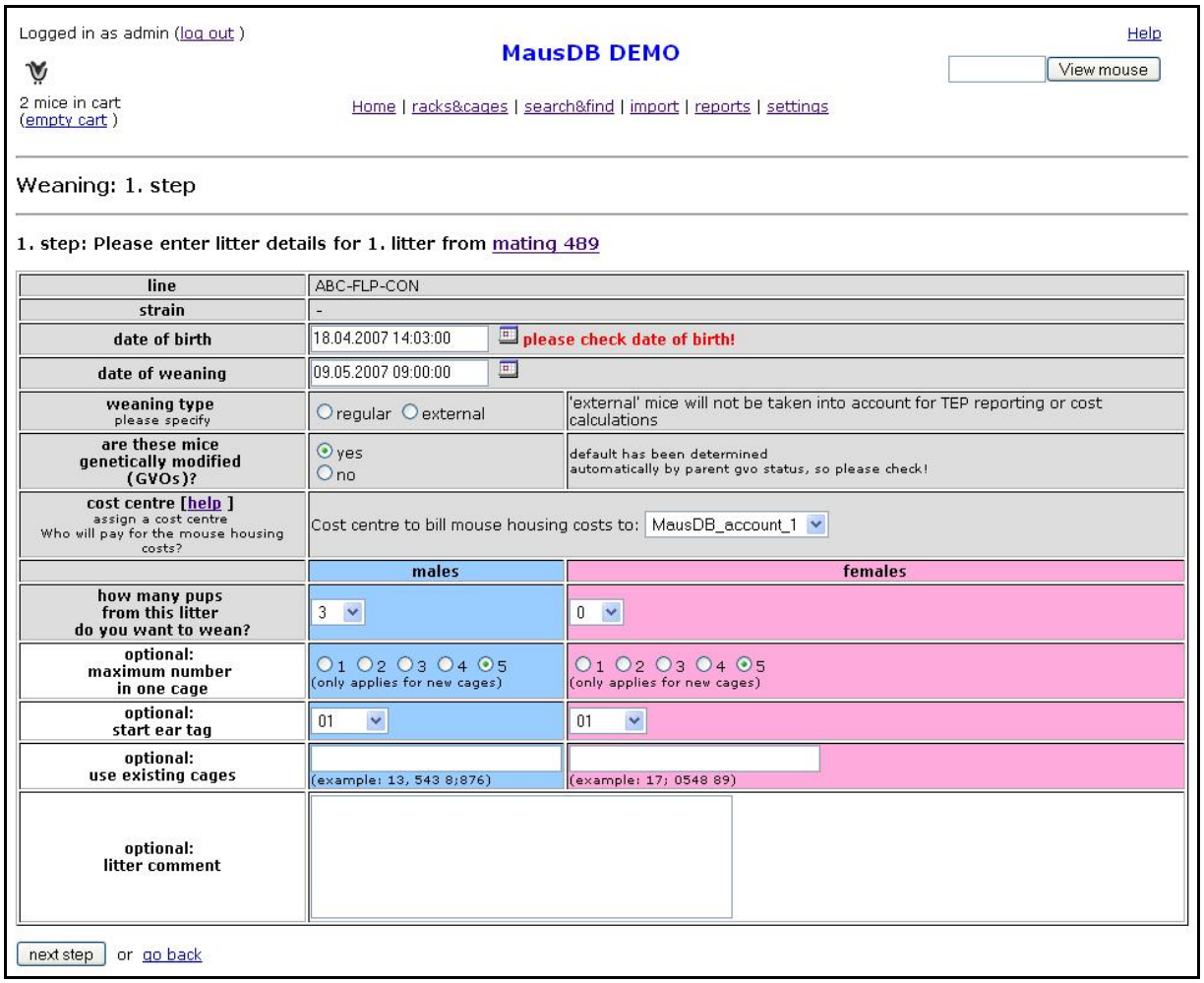



**Figure 54: Step 2: Defining litter details. In the third and fourth row, date of birth and weaning need to be controlled. In most cases, weaning type should be „regular“. Mice can be weaned as „external“ mice if they need to be managed by MausDB (e.g. for data completeness or family relationship preservation), but do live in rooms/racks, that are outside the facility which is managed by MausDB. Important: external mice are not taken into account when calculating mouse days (see 4.13.6) or numbers for the TEP report (see 4.13.3). The numbers of males and females are automatically set from previous litter reporting, but can be changed in this dialog. The maximum number of mice per cage can be selected. If males should be caged individually, the number would be set to 1. In the course of weaning, eartags are incrementally assigned starting from the given number. Alternatively, it can be set to consist of the last two digits of the mouse ID by choosing „by ID“ in the pulldown menu. In order to fill up existing cages (cages currently in use), the correspondent cage IDs can be entered. Pressing „next step“ will lead to step 2.**

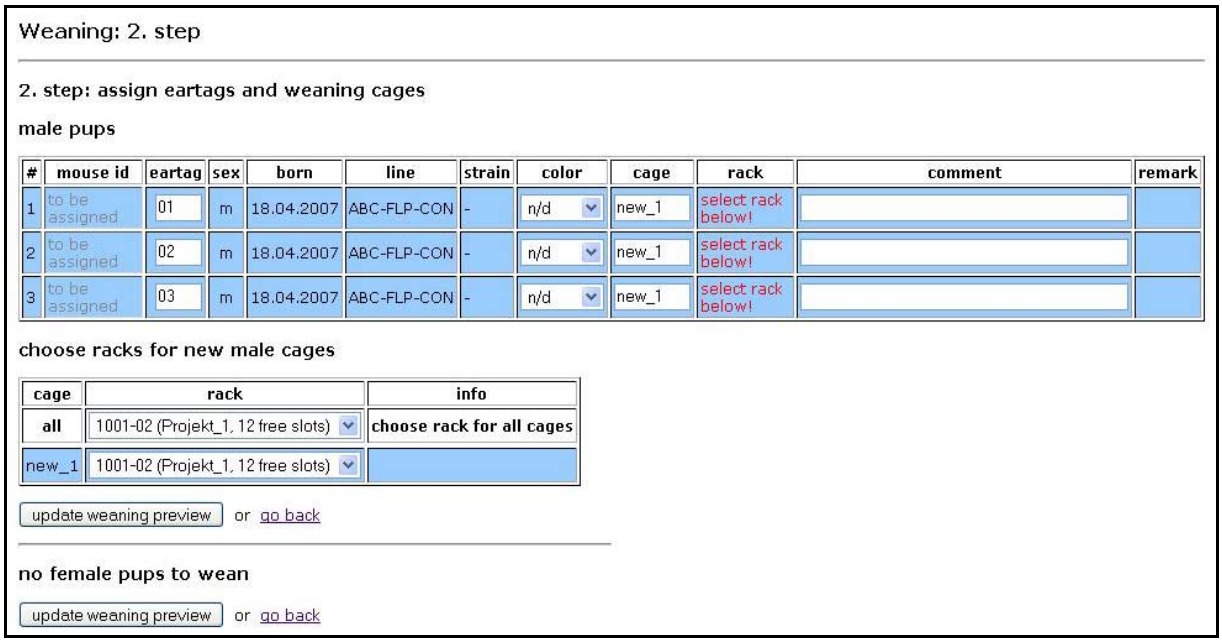



**Figure 55: Step 2: Eartag and cage assignment. The top table shows a preview for weaned mice. Mouse IDs (first column) will be generated at weaning time, eartags are incremented from the start tag given before or will be set according to the last two digits of the mouse ID at weaning time. In case no cages were given to fill up with weaned litter, cage IDs will be determined at weaning time, so they cannot be displayed here. Instead, a temporary cage ID placeholder („new_1“) will be displayed. This cage ID placeholder can be edited at this stage. The placeholder can be anything but a number, which would be interpreted as real cage ID. Mice assigned to the same cage ID placeholder will be caged together. The second table allows to assign cages to racks. This can be done individually or for all cages (first row). Pressing „update weaning preview“ will re-check for errors and the availability of cages and racks and can be repeated again and again. The screen is splitted for male and female pubs. The update procedure affects both. As soon as every cage is assigned to a rack and no errors are detected, the „next step“ button occurs at the very bottom, which will lead to the next step.**

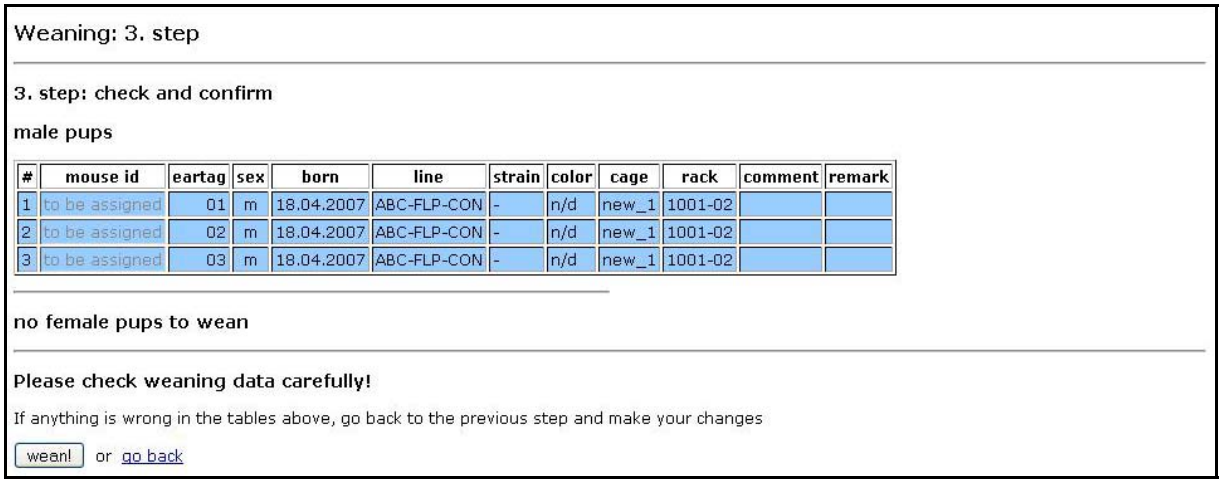



**Figure 56: Step 3: Final preview. A final preview is displayed. Pressing „wean!“ will start the weaning transaction.**

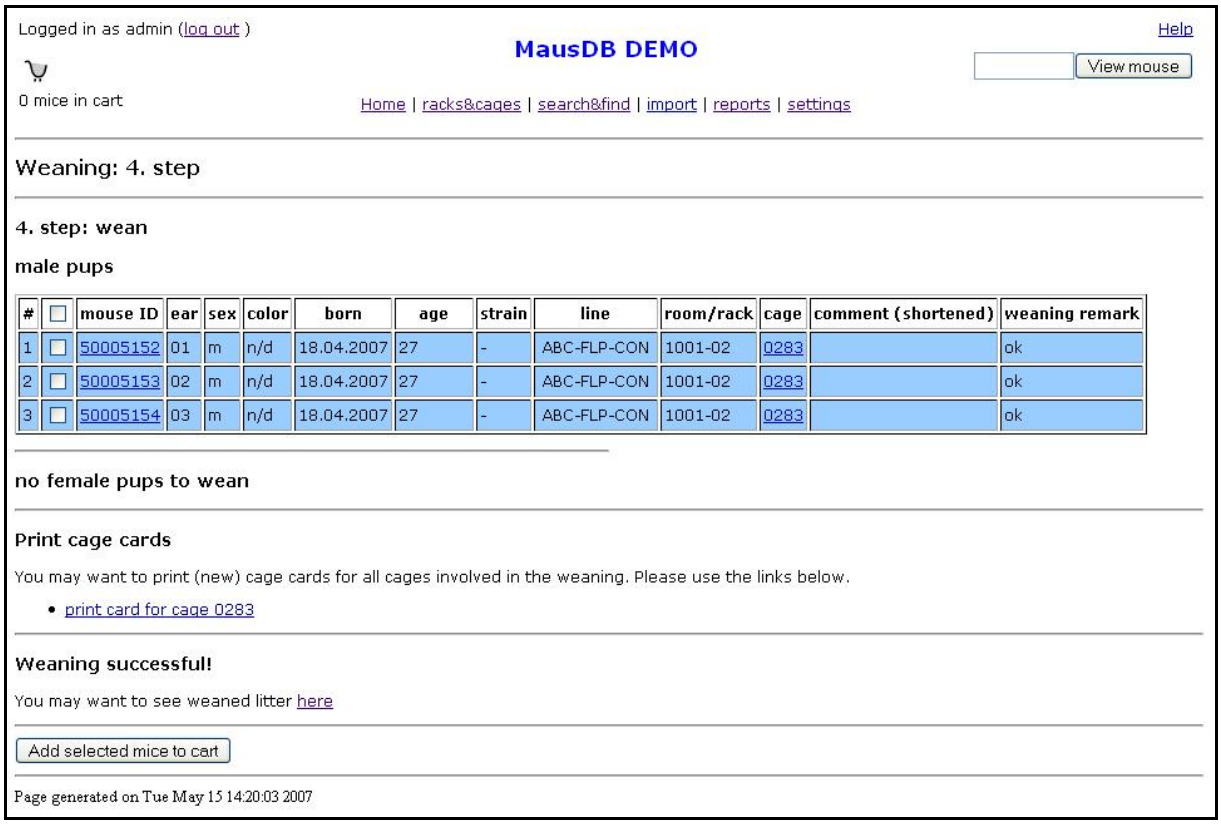



**Figure 57: Step 4: Confirmation. As the weaning has been completed, mouse and cage IDs are available and displayed as clickable links. Links to cage cards are displayed for every cage.**

## 5.5 How to import mice

Mice that are not weaned within the facility that is managed by MausDB must be imported in order to get mouse IDs. The import procedure in MausDB includes the generation of mouse IDs for all imported mice, eartag assignment and rack/cage allocation of these mice.

In the following example, a batch of 3 males is imported:

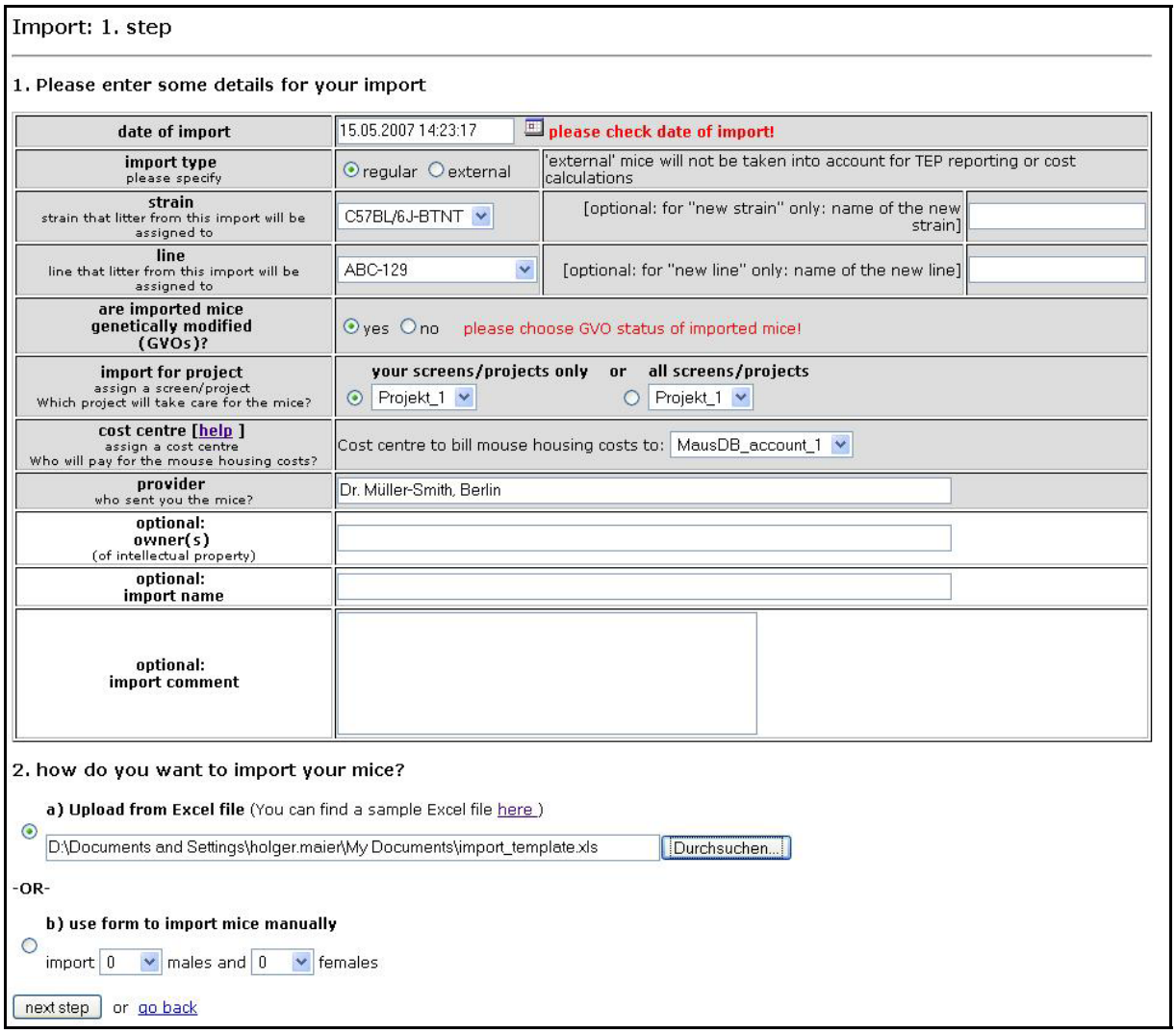



**Figure 58: Step 1: Defining import details. <u>Top Box:</u> In the first row, the date of import needs to be given. In most cases, import type should be „regular“. Mice can be imported as „external“ mice if they need to be managed by MausDB (e.g. for data completeness or family relationship preservation), but do live in rooms/racks, that are outside the facility which is managed by MausDB. Important: external mice are not taken into account when calculating mouse days (see 4.13.6) or in the TEP report (see 4.13.3). Strain (genetic background) and line can be choosen from a pulldown menu. Alternatively, new ones can be defined by selecting „new strain“ or „new line“ from the pulldown menu. In the fifth line, it must be stated whether imported mice are genetically modified or not. Project and cost centre assigment are followed by the input field for the mouse provider. All other fields in the top box are optionally.**

**There are two ways to import mice. a) import of batch mouse data from a spreadsheet file or b) manual input of mouse data (recommended only for < 5 mice). When using import from spreadsheet file, a template file must be used (available as link).**

**Pressing „next step“ will lead to step 2.**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CATID | earTag | conTag | Strain | sex | DOB | Pald | Mald1 | Mald2 |
| 2 | 10153249 | 99 | 1000 | BLc | f | 17.01.1998 | 10138239 | 10138242 | |
| 3 | 10153250 | 98 | 1000 | BLc | f | 17.02.1998 | 10138239 | 10138242 | |
| 4 | 10153448 | 01 | 1000 | BLc | f | 23.01.1998 | 10142679 | 10142682 | |
| 5 | 10153451 | 96 | 1000 | BLc | f | 25.01.1998 | 10138227 | 10138231 | |
| 6 | 10153452 | 15 | 1 | BLc | f | 25.01.1998 | 10138227 | 10138231 | |
| 7 | 10151884 | 16 | 1 | C3H | f | 30.12.1997 | 10144912 | 10144719 | |

**Figure 59: Spreadsheet template file. Batch mouse data can be imported from a file. Important: column headers must be exactly as shown here. Columns: A: mouse ID, C: cage ID, E: sex (f/m), F: date of birth (dd.mm.yyyy), G: ID of father, H: ID of mother1, I: ID of mother2 (optional)**

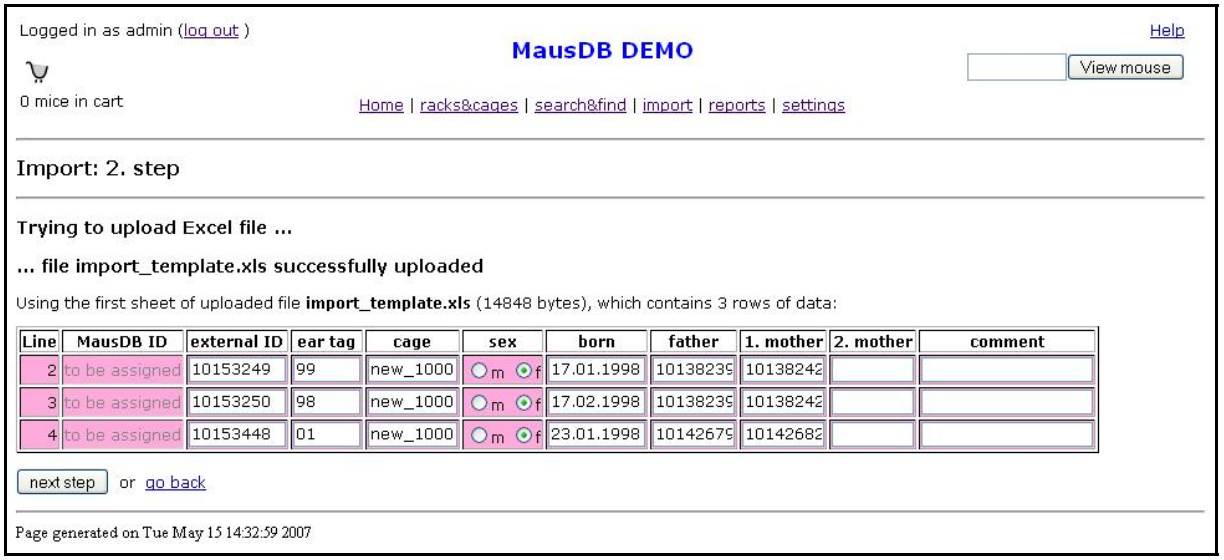



**Figure 60: Step 2: Data capture from Excel file. Data can be controlled and edited, if neccessary.**

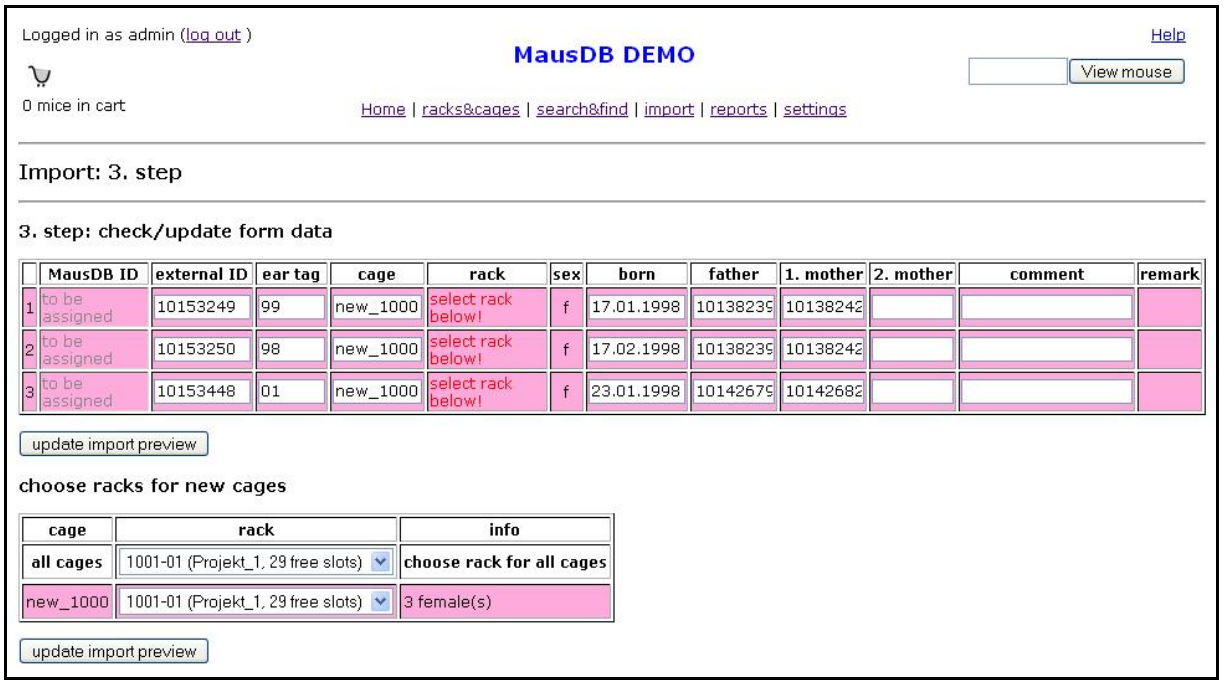
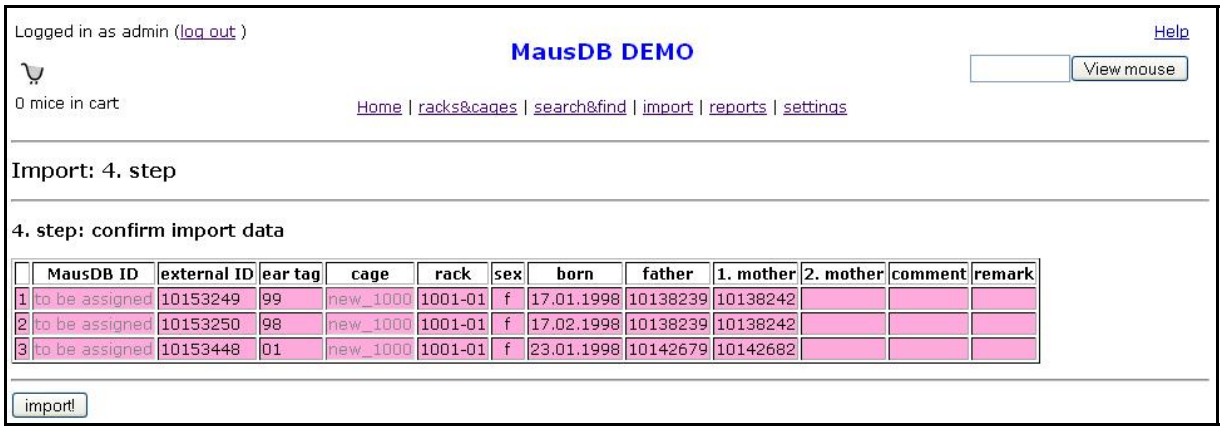
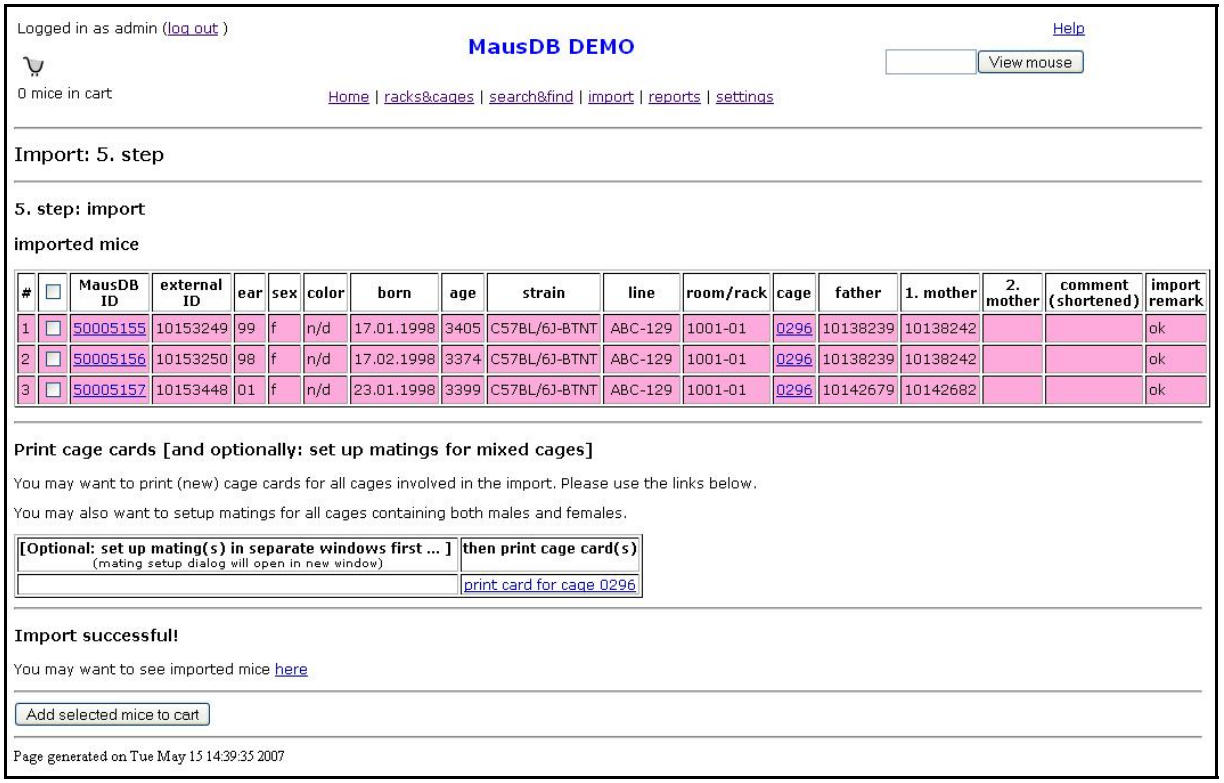



**Figure 61: Step 3: Eartag and cage assignment. See Figure 55 for explanation.**




| | MausDB ID | external ID | ear tag | cage | rack | sex | born | father | 1. mother | 2. mother | comment | remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | to be assigned | 10153249 | 99 | new_1000 | 1001-01 | f | 17.01.1998 | 10138239 | 10138242 | | | |
| 2 | to be assigned | 10153250 | 98 | new_1000 | 1001-01 | f | 17.02.1998 | 10138239 | 10138242 | | | |
| 3 | to be assigned | 10153448 | 01 | new_1000 | 1001-01 | f | 23.01.1998 | 10142679 | 10142682 | | | |

**Figure 62: Step 4: Final preview. A final preview is displayed. Pressing „import!“ will start the import transaction.**




| # | MausDB ID | external ID | ear | sex | color | born | age | strain | line | room/rack | cage | father | 1. mother | 2. mother | comment (shortened) | import remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 50005155 | 10153249 | 99 | f | n/d | 17.01.1998 | 3405 | C57BL/6J-BTNT | ABC-129 | 1001-01 | 0296 | 10138239 | 10138242 | | | ok |
| 2 | 50005156 | 10153250 | 98 | f | n/d | 17.02.1998 | 3374 | C57BL/6J-BTNT | ABC-129 | 1001-01 | 0296 | 10138239 | 10138242 | | | ok |
| 3 | 50005157 | 10153448 | 01 | f | n/d | 23.01.1998 | 3399 | C57BL/6J-BTNT | ABC-129 | 1001-01 | 0296 | 10142679 | 10142682 | | | ok |

**Figure 63: Step 5: Confirmation. As the import has been completed, mouse and cage IDs are available and are displayed as clickable links. Links to cage cards are displayed for every cage. If import leads to mixed (males and females) cages, matings can be set up quickly by following optional links.**

## 5.6 How to genotype mice

In MausDB, genotyping a mouse means to assign a locus-related genotype term to a mouse. As multiple genotypes can be managed by MausDB, a combination of locus/marker (e.g. “TNFalpha”) and genotype term (e.g. “+/-“) is stored.

In the following example, three mice from the previous import example have been put in the cart:

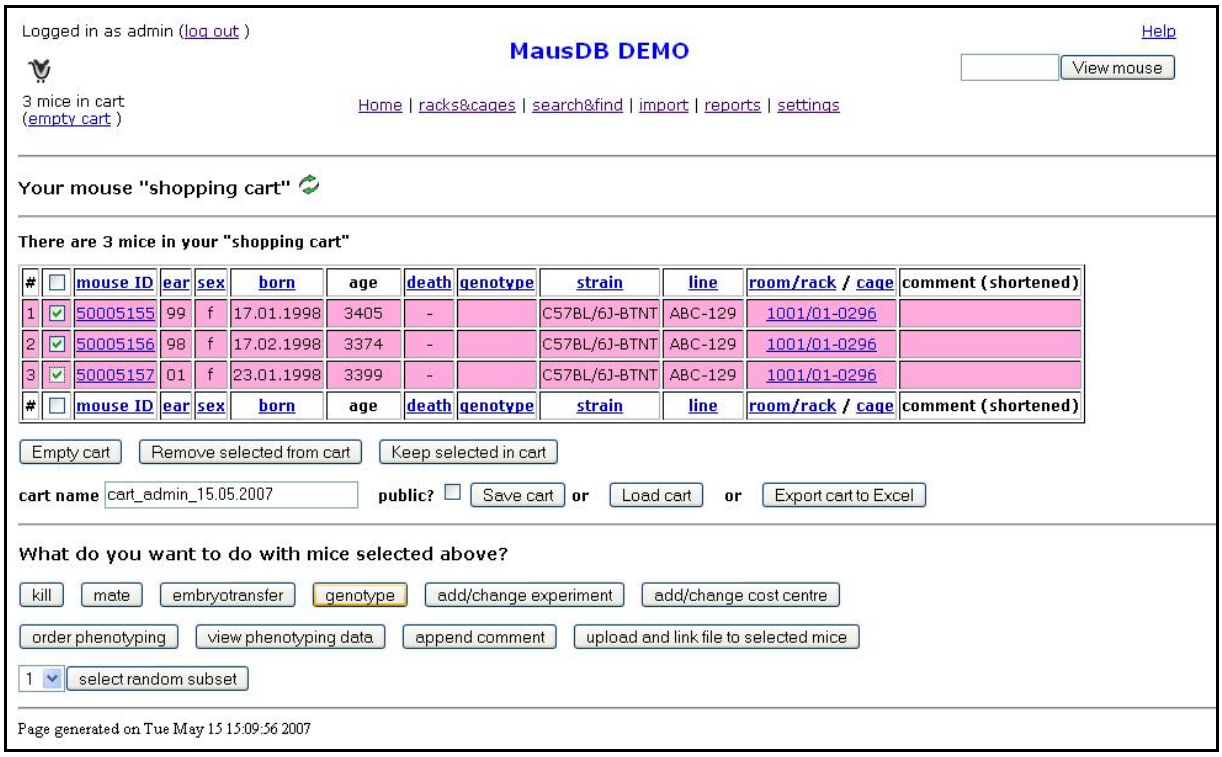



**Figure 64: Mouse selection. In the cart, mice are selected using the checkboxes. Pressing „genotype“ in the bottom functions bar will lead to the genotyping procedure.**

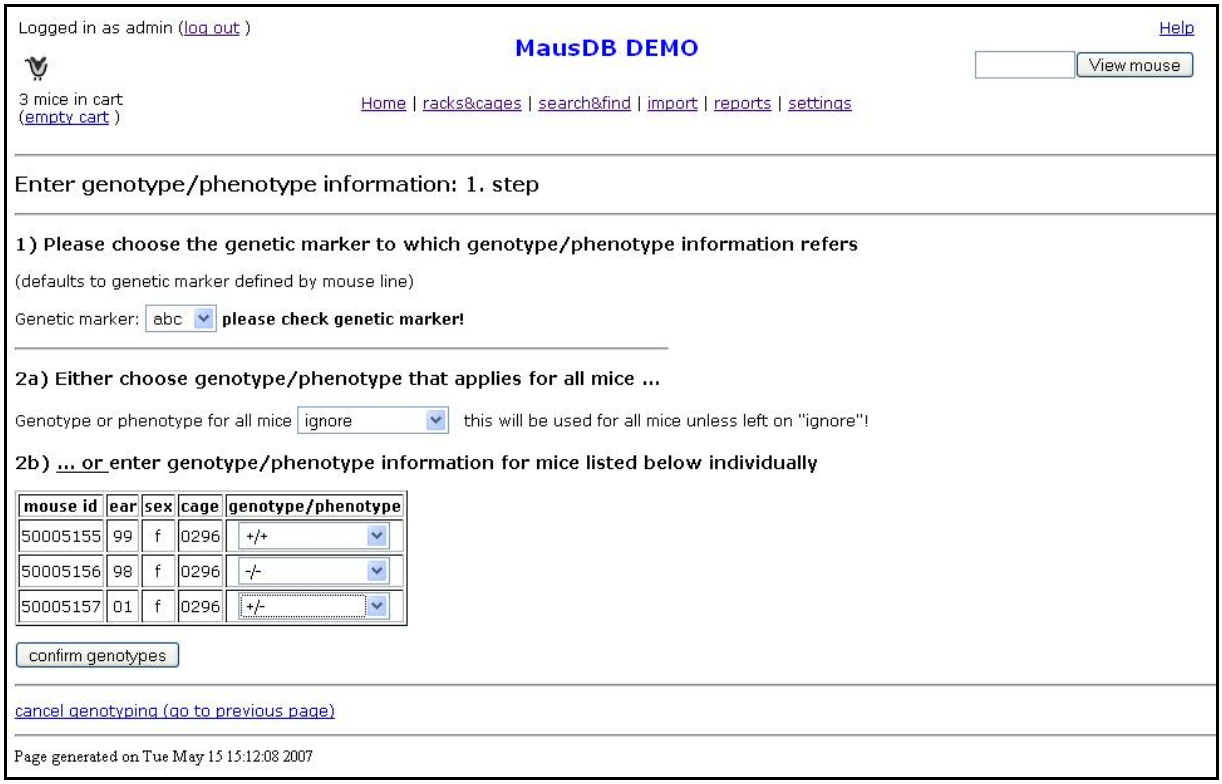



**Figure 65: Step 1: Genotype assignment. In the first step, the locus / genetic marker to which the genotype refers must be chosen from a pulldown menu. In the second step, genotype terms can be assigned individually (2b) or for the whole set of mice (2a). Important: when assigning genotypes individually, „ignore“ must be selected in the upper pulldown menu. Pressing „confirm genotypes“ leads to the next step.**

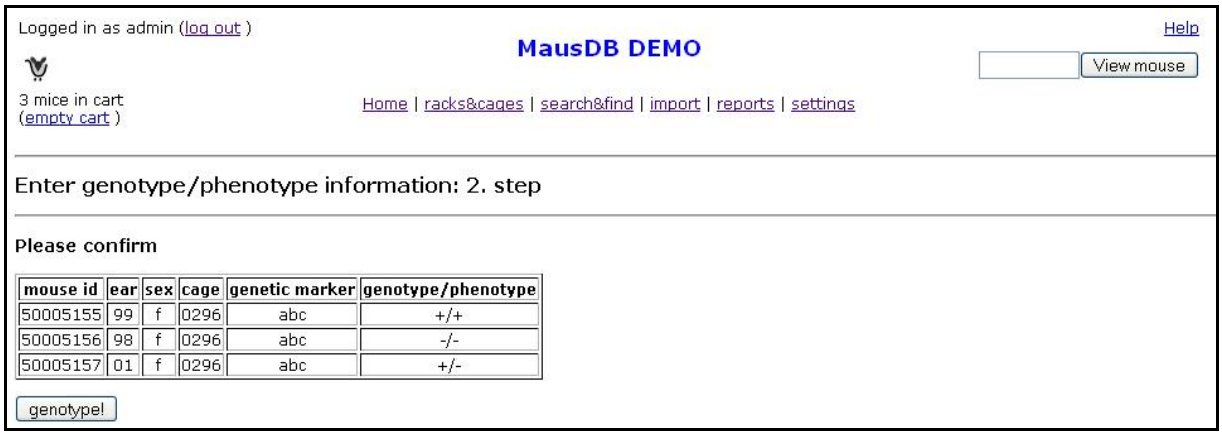



**Figure 66: Step 2: Preview. After final preview, the genotype procedure can be started by pressing „genotype!".**

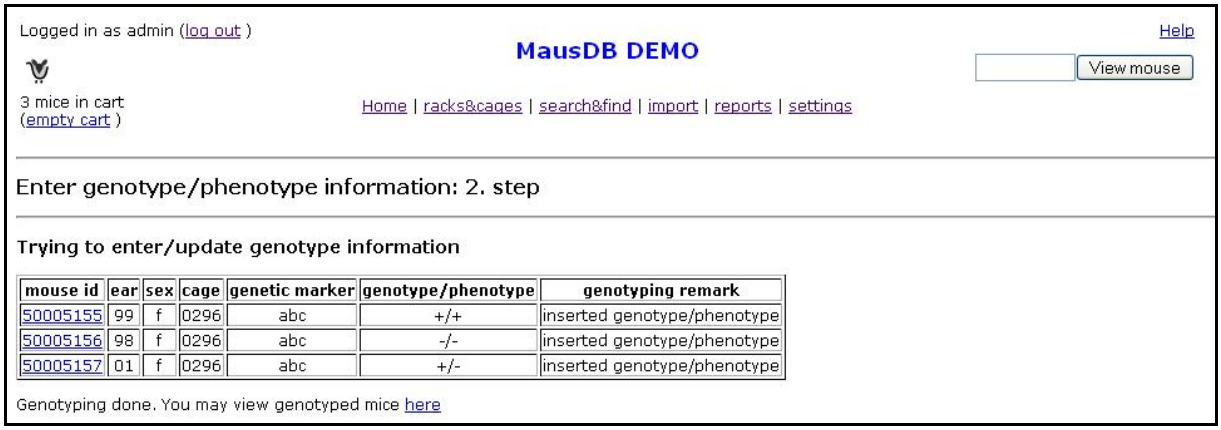



**Figure 67: Step 3: Confirmation**

## 5.7 How to change cost centre assignment for mice

During the life of a mouse, the cost centre that has been assigned at weaning or import time, may change. In the mouse details page (see 4.6) or the cart, the bottom function bar contains a button "add/change cost centre" (see below).


**Figure 68: The standard function bar that is available on the bottom of the mouse details page, the rack and cage view, and the cart.**

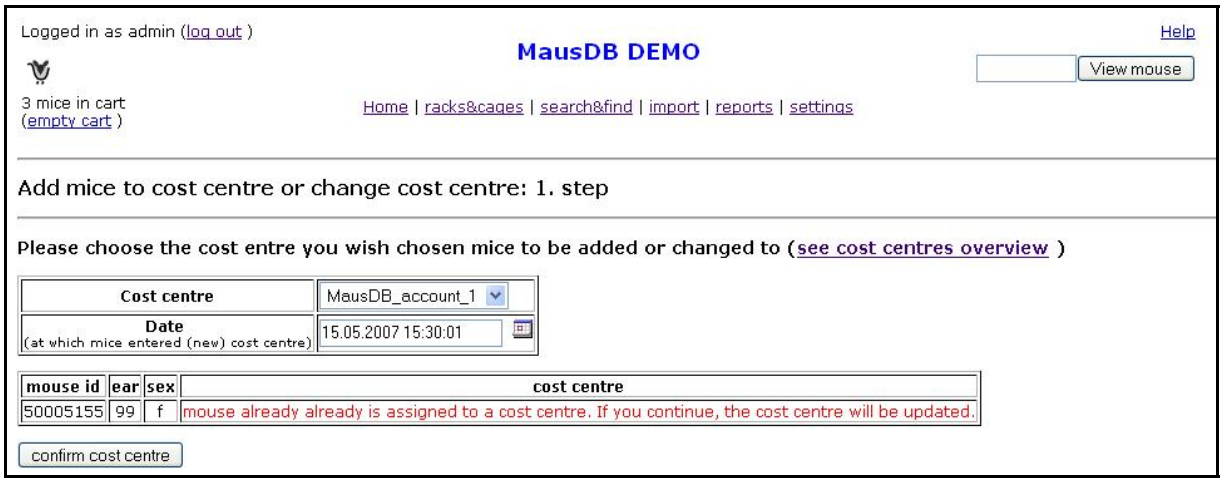



**Figure 69: Changing the cost centre for a mouse. The new cost centre can be selected from a pulldown menu. The date of cost centre change must be given. The current cost centre assignment is displayed. Pressing the „confirm cost centre“ button will lead to a preview page, where the procedure can be finalized.**

## 5.8 How to change experiment status of mice

According to German law, mice that are subject to experiments must be reported. The normal case in MausDB is defined as “breeding”. When a mouse starts into an experiment, date of experiment start and the experiment itself must be reported. At any time a mouse can be assigned to no or one experiment. However, during lifetime of a mouse it can be assigned to several consecutive experiments

As with cost centre assignment (see 5.7), this can be done for one mouse from the mouse details page or for multiple mice from the cart, cage or rack view.

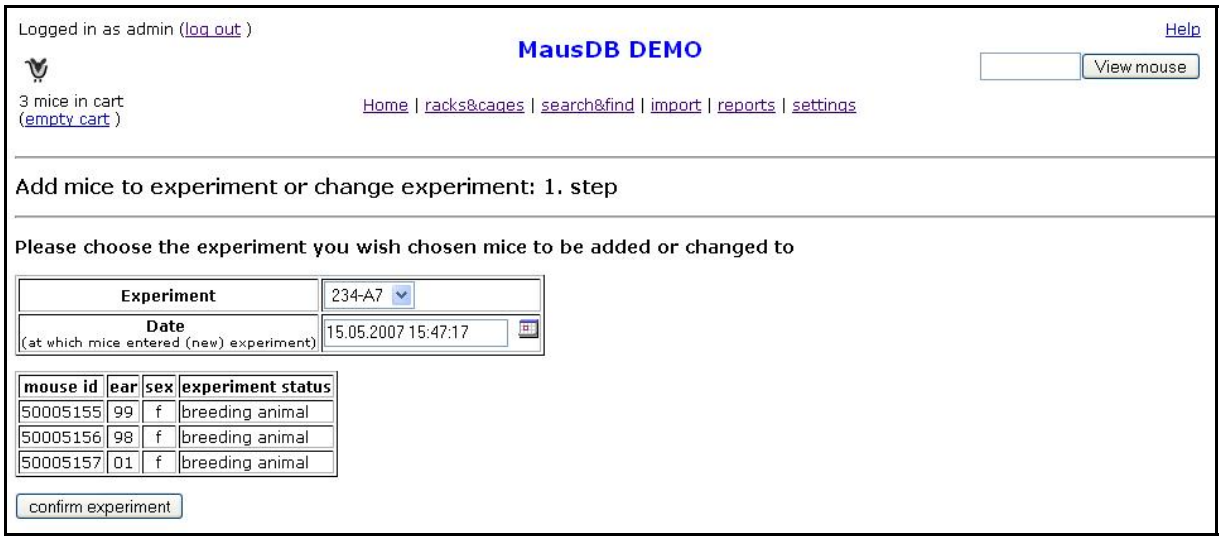



**Figure 70: Step 1: Defining experiment and start date. The current status of selected mice is shown in the bottom box. Pressing „confirm experiment“ leads to a preview page, where the procedure can be finalized.**

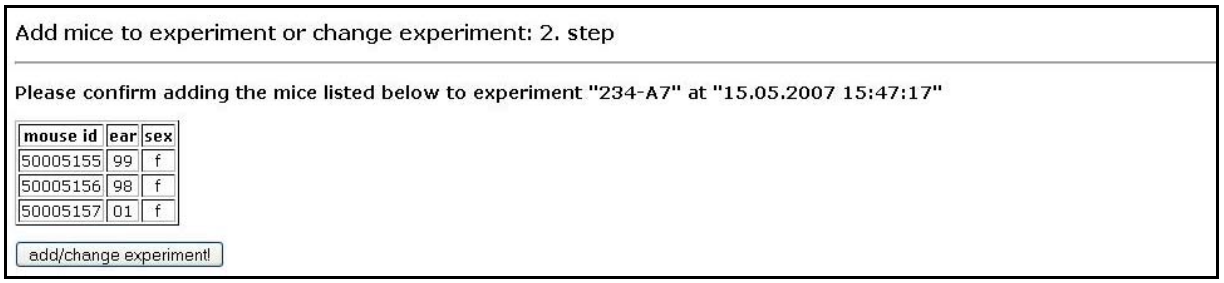



**Figure 71: Step 2: Final preview. Pressing „add/change experiment!“ will finalize the procedure.**

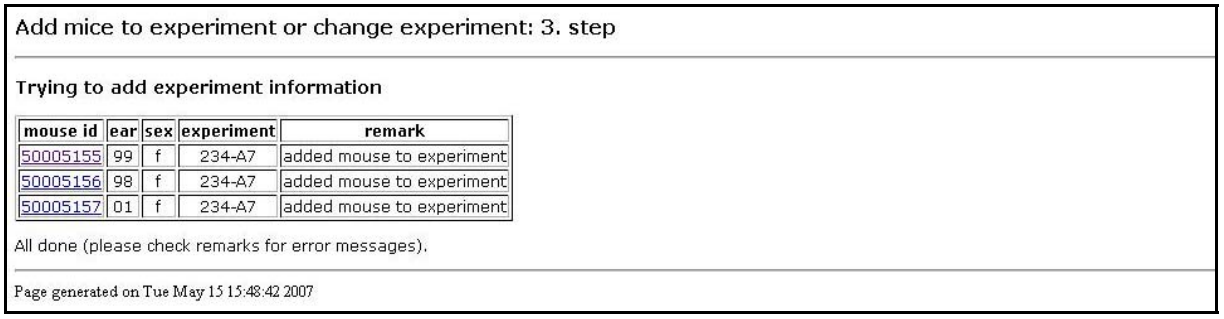



**Figure 72: Step 3: Confirmation. The remarks column may contain error messages.**

## 5.9 How to move a mouse to another cage

Starting from the rack or cage view, mice can be transferred to other cages. There a two cases:

a) moving a mouse to an empty cage. A new cage ID must be assigned and a rack must be assigned to this cage.

b) moving a mouse to a cage with other mice that is already in use. Cage ID and rack assignment are already defined.

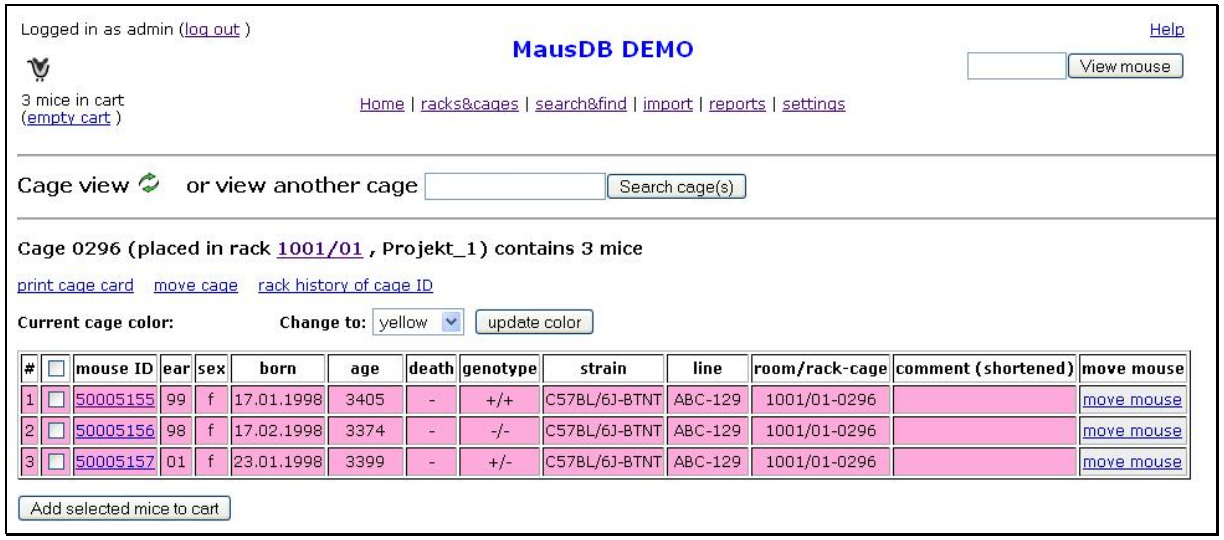



**Figure 73: Starting a mouse transfer to another cage from the cage view. Clicking „move mouse“ on the mostright colum will start the move procedure for that mouse.**

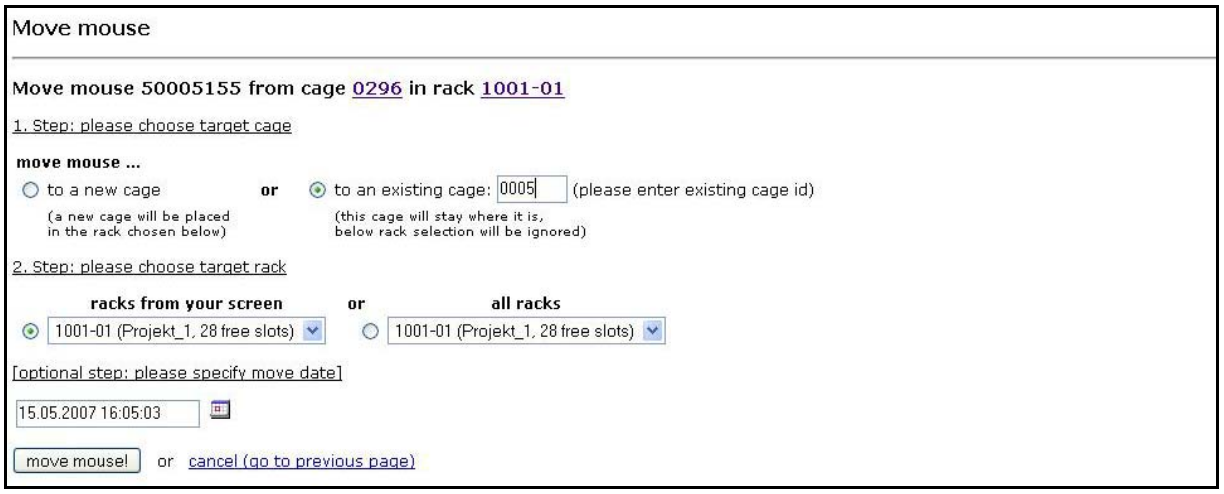



**Figure 74: Target cage definition. In the first step, the user must decide whether to move the mouse into a new cage or into an existing cage. In the new cage scenario, the second step defines the target rack for the new cage (which is not neccessary when moving into an existing cage). The third step defines data and time of the movement.**

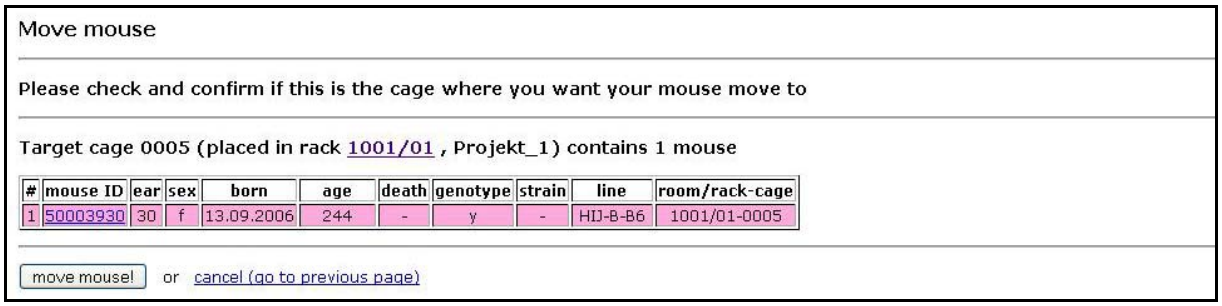



**Figure 75: View into an existing cage. In case an existing cage has been chosen as target cage, a view of current mice in this cage is displayed as a means of control. Pressing „move mouse!“ will finalize the procedure.**

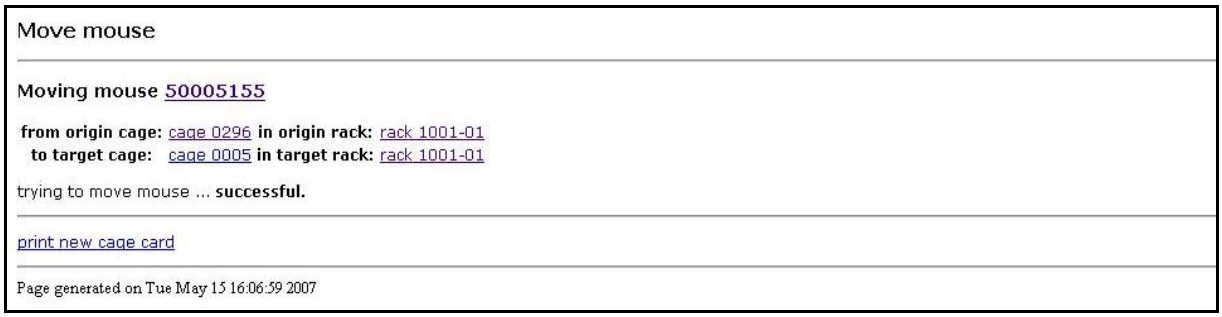



**Figure 76: Confirmation of mouse transfer. Clickable links for target cage and rack as well as for the target cage card are displayed.**

## 5.10 How to move a cage to another rack

Starting from the rack or cage view, a whole rack (with all mice) can be moved to another rack. Mice in this cage do not change their cage IDs. There is no feature to move all cages of one rack to another rack in one transaction, the cages have to be moved one by one.

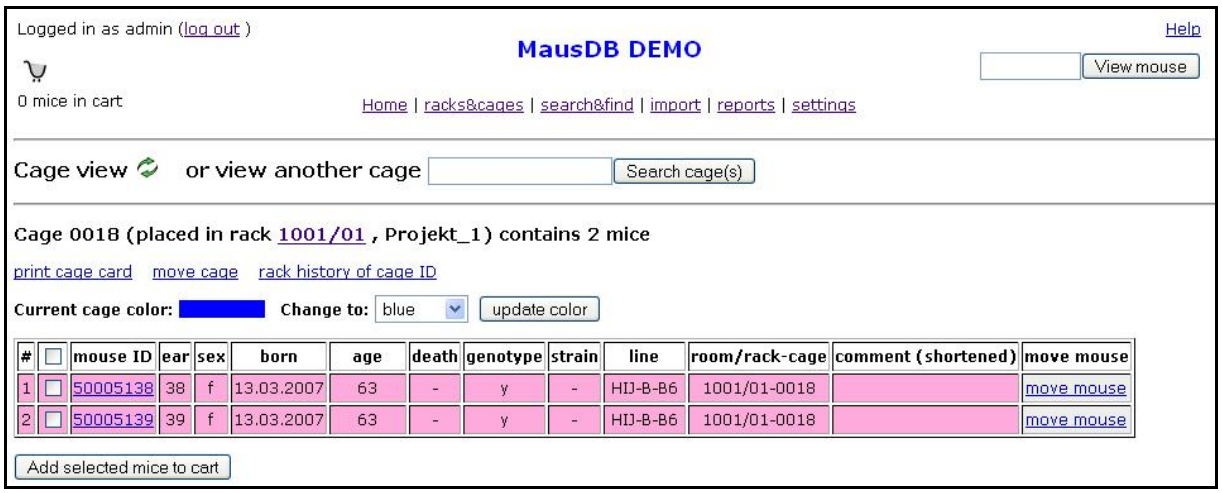



**Figure 77: Starting a cage transfer to another rack from the cage view. Clicking „move cage“ on top of the color bar will start the move procedure for that cage.**


**Figure 78: Definition of move date and target rack. Racks can be chosen from „own“ project-linked racks or from all racks managed by MausDB. Pressing „move cage!“ will finalize the procedure.**

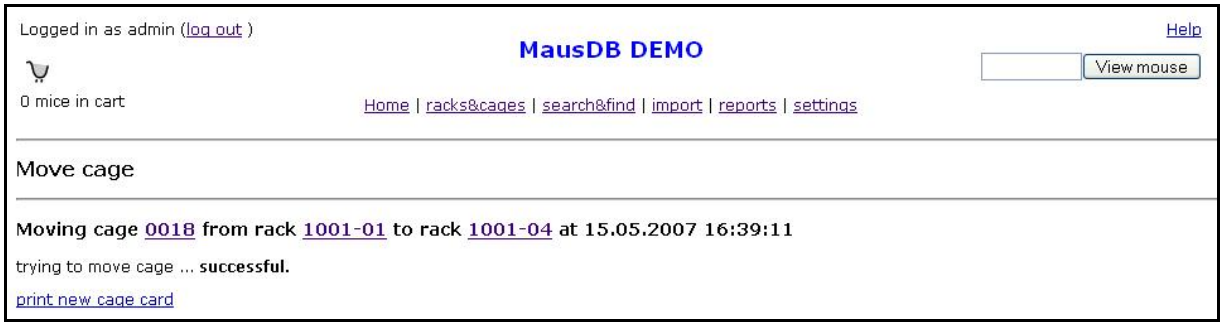



**Figure 79: Confirmation. The cage transfer is confirmed and a clickable link to the cage card is displayed.**

## 5.11 How to cull mice

As with other standard procedures, culling of mice can be started for one mouse from the mouse details page or for multiple mice from the cart, cage or rack view.

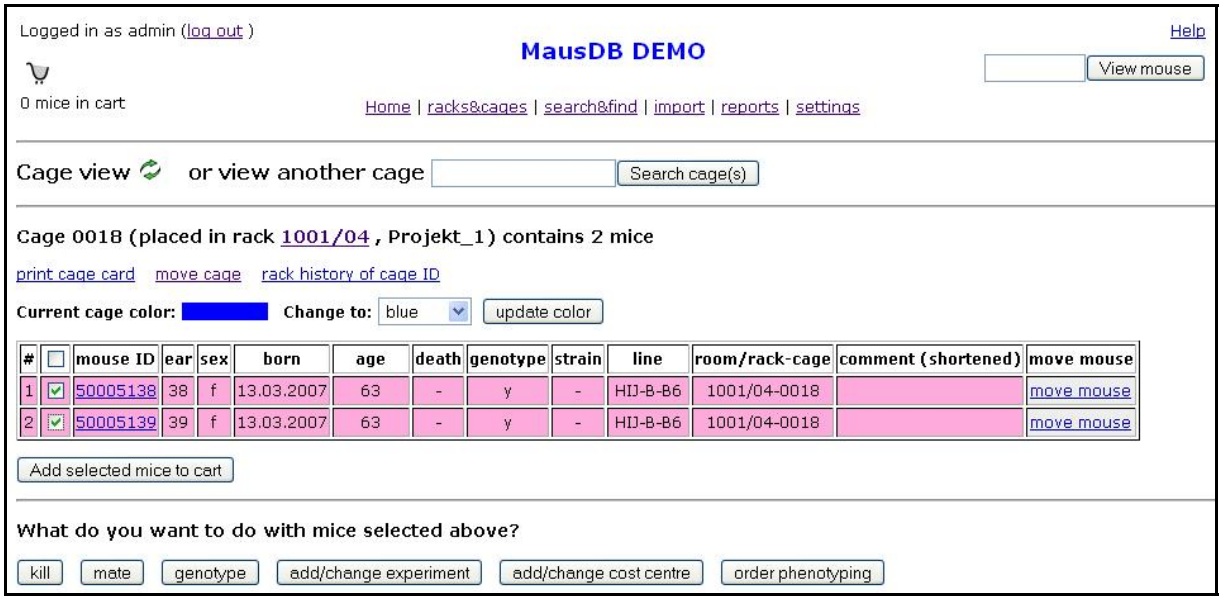



**Figure 80: Starting from the cage view, mice subject to culling are selected using the checkboxes. Pressing „kill“ in the bottom functions bar will lead to the next step.**

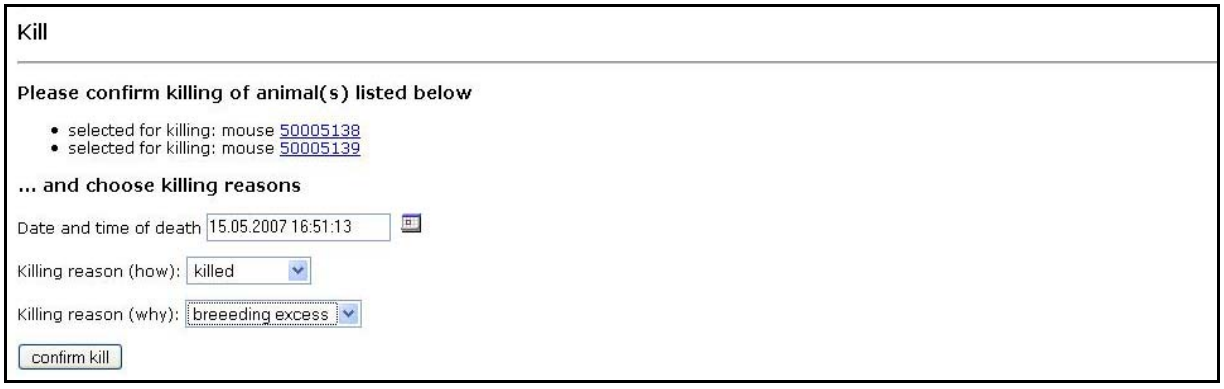



**Figure 81: Defining culling date and culling reasons. Pressing „confirm kill“ will finalize the procedure.**

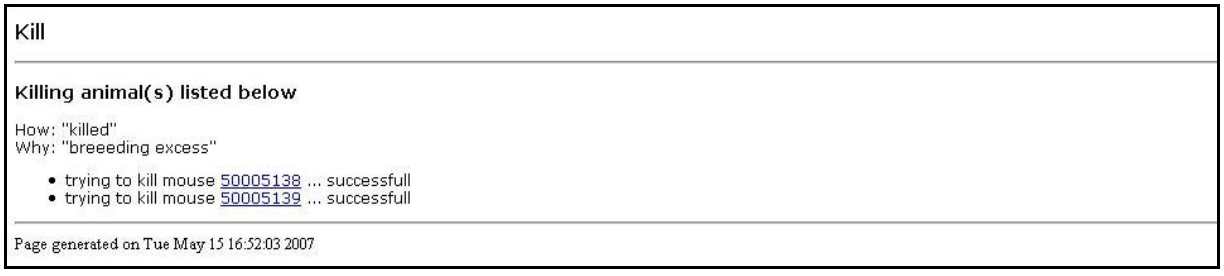



**Figure 82: Confirmation of culling.**

# 6 MausDB Administration

## 6.1 Backup database

### 6.1.1 Using backup script

Fully automated backups can be scheduled by using the backup script (described in 2.3.6).

### 6.1.2 Manual backups

At any time, a full dump of the database can be done manually:

```
# mysqldump --opt –u <username> –p<password> mausdb > dumpfile.sql
```

[Please note: this may take some minutes]

### 6.1.3 Restore from backup

A database can be restored from a full dump

**(WARNING: this will overwrite your current database!)**

```
# mysql –u <username> –p<password> mausdb < dumpfile.sql
```

[Please note: this may take considerable time depending on the size of your database]

For more sophisticated restore scenarios like point-in-time recovery, please check the MySQL documentation.

## 6.2 Blocking user interaction (“Global lock”)

There is a mechanism called “global lock” implemented in MausDB that stops user interaction via the web user interface. It is strongly advised to set a global lock in two situations:

- when damage to the database occured (e.g. by manipulation on database level). Immediately after a database damage occured or is noticed, a global lock should be set. This prevents new data to be written to the database and facilitates database rollback and point-in-time recovery.

- when the database server needs to be stopped for service or updates.

### 6.2.1 Setting a global lock via web user interface

Log in using an account with admin rights and choose “set or release global locks” from the “settings” menu. The web user interface for non-admin accounts will immediately be blocked. **Be aware that the web interface for admin accounts will not be blocked** and remains accessible. As admin, you will be able to work with MausDB and finally release the global lock again.

### 6.2.2 Setting a global lock manually

In case the web user interface is not accessible you may set a global lock manually:

1) Open /usr/lib/cgi-bin/mausdb/config.rc in an editor
```
# sudo nano /usr/lib/cgi-bin/mausdb/config.rc
```

2) set MAUSDB_LOCK from "false" to "true"

3) repair/manipulate the database or run updates on your server ...

4) set MAUSDB_LOCK back to "false"

## *6.3 Administrational overviews and settings*

Users with administrative rights (user_role = ‘ua’) can access many frequently needed administrative functions via “reports” and “settings” in the main navigation bar.

## *6.4 Administration on database level*

However, some infrequently needed or complex functions are not integrated into the web user interface. In these cases, database manipulation has to be carried out on database level.

Commented SQL scripts for some frequently used tasks are available from the downloaded repository and should be located in ***/home/admin/mausdb/SQL.***

**WARNING: MANIPULATION ON DATABASE LEVEL IS PRONE TO GENERATE DATA LOSS OR DATA CORRUPTION!**

**PLEASE NOTE OUR ADVICES ON SQL-LEVEL DATABASE MANIPULATION:**

1) Make a full database dump before manipulating the database
2) set a global lock before manipulating the database (see 6.2).
3) read the commented scripts carefully before running them.
4) make sure you fully understand what the scripts are doing before running them.
5) in case you feel unsure about 4), ask someone with more SQL skills for help.
6) Think twice before executing SQL commands.
7) for update commands: make sure there is a “where” clause in your statement
8) for delete commands: make sure you also delete corresponding entries in other tables in order to maintain referential integrity.