HOBOs are attached to a rear leg of cows/calves/goats using vet-wrap. They are commonly used to record standing and lying time (including time lying on each side), however other applications (e.g., running speed) also exist. The amount of data a HOBO is capable of storing is based on the logging frequency. For monitoring standing and lying time, we typically log every 1 minute, which allows for approximately 14 days of data storage.

NOTE: You should use the maximum time with caution, as prolonged use on one location can cause sores. The HOBO Lite program will calculate the maximum length of time for you when you set the logging interval (see Section 2.6 – "Logging Interval")

1. Check List: Before Starting

Supplies:
- Vet-wrap, approximately 1 roll for 2 cows (NOTE: only use red for calves, do not use for milking cows)
- Cling Wrap (for wrapping HOBOs)
- Safety knives are used to cut of the vet-wrap from the cows' legs; regular knives and scissors should never be used on cows (NOTE: Knives get dull after about 25 loggers, ensure you have a good supply of sharp knives; if you need additional knives, asked Nelson)

HOBO File Naming:
- It is very important that you name your HOBOs properly when launching them.
- **Proper file names can begin with any combination of letters/number, but MUST end with a underscore and the cow's number**. For example, if your cow's number is 5006 your file naming could appear as:
  - *week1_5006*
  - *dry_off_gr_1_5006*
  - *anything_at_all_5006*
- If you are collecting data on different farms, name the files ending with the farm's number, underscore, cow's number: *anything_56_5006*

2. Launching/Activating

NOTE: Activating a HOBO deletes all data from the tag. Make sure previous data is saved!

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Updated SOP (2013) created by Gosia Zobel (g_zobel@yahoo.ca) and Nuria Chapinal (nchapinal@yahoo.com)
For questions please contact Dr. Marina von Keyserlink (nina@mail.ubc.ca) or Dan Weary (danweary@mail.ubc.ca)

1. Open the **HOBOware Lite** program

Figure 1: USB HOBO base station

2. Connect the USB base station (Figure 1) to the computer (if not already connected).

3. Insert the logger to the base station

4. Click: Launch Device

5. Make a list of cow #s corresponding to HOBO #s

6. In the Launch Logger Window you will need to do five things:
   - Check the battery level (NOTE: it should be 100%, if it is not, set this HOBO aside and mark it for testing)


   - **Description:** provide a descriptive name for the file, keeping in mind Section 1.2 – the file MUST end with a underscore and the cow's 4 digit number (e.g., trial2_5054).

   - **Channels to Log:** Select options 1 – 3 (X-axis, Y-axis, Z-axis)

   - **Logging Interval**: Usually 1 min for lying and standing data. Remember that as you increase the logging interval frequency, you will need to change the HOBO more often. The Logging Duration section will show the approximate time it will take to fill the logger).
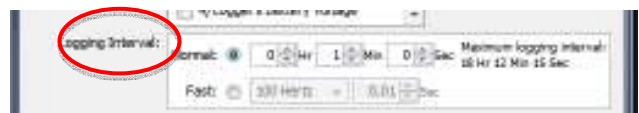
- **Launch Options:**
    - Now: starts logging as soon as it is launched (time shown)
    - At Interval: starts logging at the time shown (at selected logging interval)
    - Delayed: set the date and time to start logging (most useful option)
    - Trigger: starts logging on command by using the magnet in the base station coupler to trigger a start (can be used to start the loggers as they are attached to cows).

7. Click: **Launch** and wait for the logger to be configured - when the pop up window disappears, the logger is ready. NOTE: A launched logger will have a red light that blinks every 5 seconds in the top left hand corner).
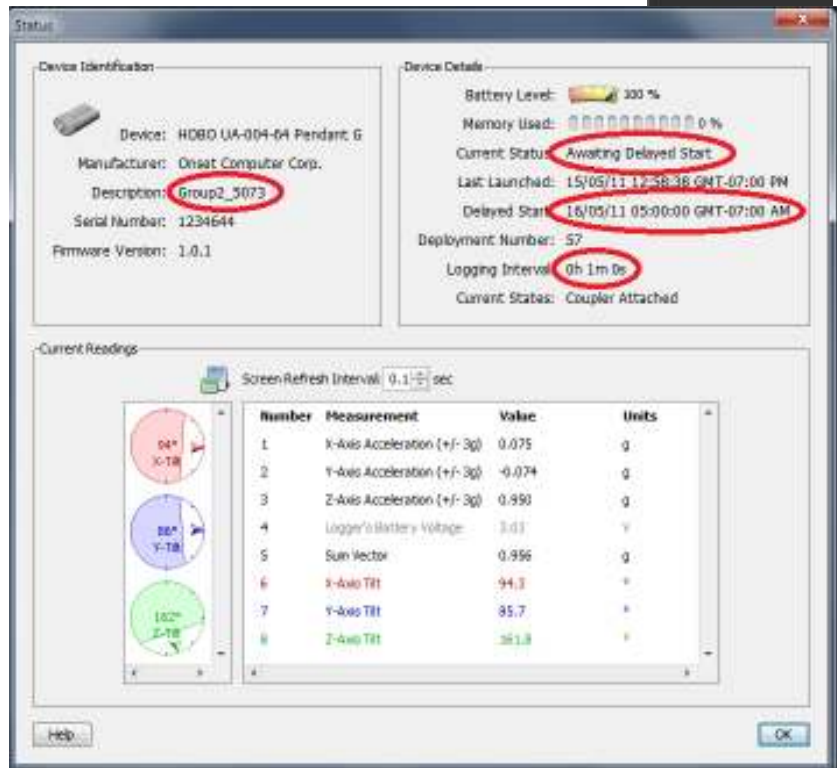
8. It is a good idea to check the **status** of the logger to make sure it is launched properly.

   Click: **Device Status** at any time while the logger is attached to the base station.

9. Things to check are that your logger is named correctly, the logging interval and that the correct start option and time is set.

    - **NOTE:** The status device also allows you to visualize what the logger is reading in the Current Readings section(acceleration and tilt in three axes) by moving/tilting the logger around while it is connected.

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10. Disconnect the logger from the base station.

11. Repeat above steps for all HOBOs.

3. Preparing HOBO Data Loggers

NOTE: These instructions are to attach the logger horizontally on the **OUTSIDE of the RIGHT leg**.
See notes at the end of the section 4 to modify the procedure to attach the logger on the inside of the leg, on the left leg or vertically. Consistent orientation of the loggers is crucial to obtain correct lying behaviour estimates. If the orientation of the axes is different from described below, the SAS code (see appendix) will not yield correct estimates of lying times and lying sides.

1. Launch HOBOs (see Section 2)
2. Cut pieces of foam (in storage room) to extend past the size of the HOBO.

3. WATER PROOFING: METHOD 1 (Plastic Bags)
   a. This way is the easiest (but there's a second option below in case you cannot get plastic bags).
   b. Take the HOBO on the foam and insert into plastic bag and seal it.
   c. Make sure it is properly <u>sealed.</u>

4. WATER PROOFING: <u>Method 2 (Cling Wrap)</u>
   a. Rip off a piece of cling wrap, approximately the size as a piece of 8x10 paper.
   b. Place HOBO on top of the foam in the top left hand corner, with purple side up and so you are able to read the writing.

   a. Stretch the cling wrap tightly around the logger (start with the larger end, ensuring it is well sealed, as this is the end which is open to moisture). Be careful to keep the logger facing the same way as you wrap it. Write the HOBO # and/or the cow # on the wrapped HOBO or the HOBO in the bag – the number should be the correct way up (as this will help you orient it properly on the cow's leg – with the bigger rounded end pointing towards the tail). <u>See section 4.1 for proper placement</u>)

Location of the red blinking light

NOTE: If you lose track of the way it is facing, cup your hand around the HOBO and you should be able to see the red light blinking in the top left hand corner.

This light is blinking when the logger is either logging, or set to log at some point. Make sure it is NOT blinking when HOBO is stored.

# 4. Attaching HOBO Data Loggers to Cows' Legs

1. Wrap at least two layers of vet-wrap around the lower part of one hind leg. The wrap minimizes abrasions.

2. Hold the roll (you don't need to cut the vet-wrap), and place the logger on the leg.
   ✓ Make sure it is horizontal, and with the red light facing you in the top left hand corner. In other words:

   - X-axis should be parallel to the ground pointing towards the cranial direction (head)

   - Y-axis should be perpendicular to the ground pointing towards the dorsal direction (up to the back)

   - Z-axis should be parallel to the ground, pointing left (the midplane of the cow if on the right leg)

   NOTE: The SAS code can only be used if axes are oriented exactly as described above. See below to obtain the same orientation when placing HOBO inside the leg or on the left leg.
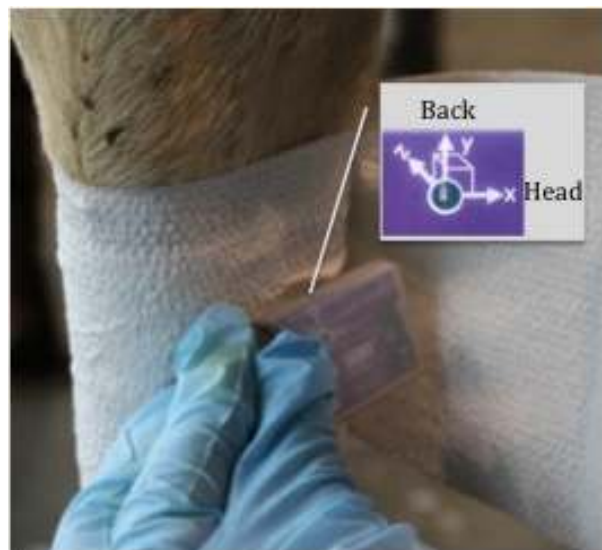
3. Continue wrapping over the logger until it is secured – five layers should be enough. (Works out to be about ½ roll of vet-wrap per cow)
4. Cut the vet-wrap and make sure that the end is properly stuck to the rest of the wrap.

NOTE: You should be able to easily stick two fingers between the leg and the vet-wrap.

NOTES ON PLACEMENT

INCORRECT HORIZONTAL PLACEMENT:

✘ Upside down
(y-axis will be pointing to the ground)

✘ Not horizontal
(good luck interpretting your data!)

INSIDE OR LEFT LEG ATTACHMENT:

In some circumstances (orientation of the parlour, injuries in on the right leg) you might need to place the hobo on the inside of the leg, or the left leg.
Leg placement does not really matter, as long as the orientation of the axis is correct:
- X-axis should be parallel to the ground pointing towards the cranial direction (head)
- Y-axis should be perpendicular to the ground pointing towards the dorsal direction (up towards the cow's back)
- Z-axis should be parallel to the ground, pointing left (towards the midplane of the cow if it is on the right leg, and **away from the cow if it is on the left**).

NOTE: You might need to change the way the foam is wrapped (section 3), so that it is always in contact with the skin.
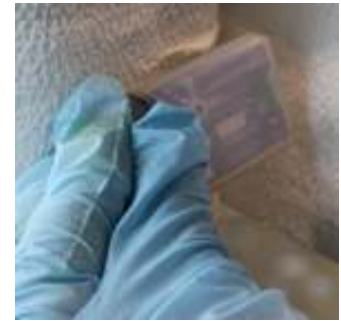
Right leg, outside:
- You'll see the word HOBO.
- Y (pointing up)
- X (pointing to the head)
- Z (pointing inwards towards the belly and left leg)
- Rounded end pointing towards the tail

Left leg, inside:
- You'll see the word HOBO.
- Y (pointing up)
- X (pointing to the head)
- Z (pointing through the left leg and away from the cow)
- Rounded end pointing towards the tail

Right leg, inside:
- You will see the clear back of the HOBO.
- Rounded end pointing towards the tail

Left leg, outside:
- You will see the clear back of the HOBO.
- Rounded end pointing towards the tail

VERTICAL ATTACHMENT:

- If you want to place the logger vertically in the case of smaller legs (i.e., on a calf or a goat), remember you will be using the X-axis NOT the Y-axis for your analysis.

- Ensure the X-axis is POINTING UP (the round end of the HOBO is on the bottom, and the thin end pointing up). (Otherwise, you will need to invert your data, as it will be negative).

- Z-axis should be parallel to the ground, pointing left (towards the midplane of the cow if it is on the right leg, and away from the cow if it is on the left).
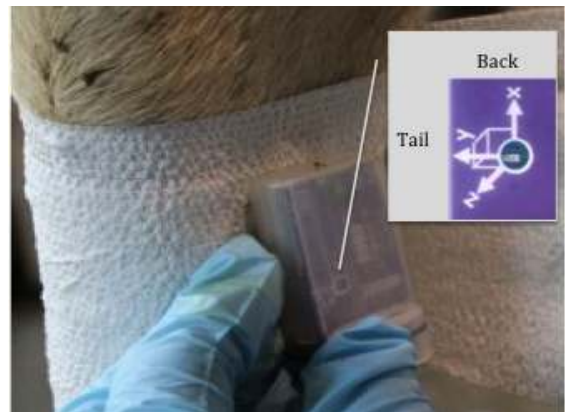
5. Removing HOBO Data Loggers from Cows' Legs

It is safest to remove HOBOs in the parlour. Unless your trial prevents you from bringing the cows into the parlour, aim to take HOBOs off there. **See note below.**

1. Cut the vet-wrap with a SHARP safety knife (this means using a new knife for per dozen cows).
2. Unwrap the HOBO and discard the vet-wrap.
3. Make a note if the HOBO slipped out of the original position. You might need to discard the data.
4. You can usually re-use the foam for another application, unless it has gotten wet.

NOTE: If you must take your HOBOs off outside the parlour, the safest way is to headlock the cow, and use a pair of child's safety scissors (they are easier to use "quickly" than the safety knives). These scissors gum up pretty quickly though – so aim to replace them after half a dozen cows.

6. OFFLOADING HOBO DATALOGGERS

1. Open the **HOBOware Lite** program
2. Connect the USB base station to the computer (if not already connected).
3. Insert the logger to the base station

4. Click: **Readout device** (second from left)
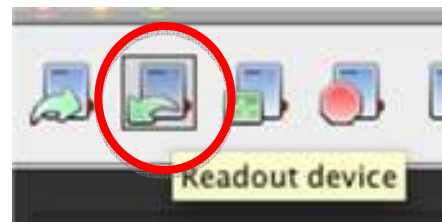
5. You will be prompted that hte logger is still logging, and be asked if you want to stop logging. Click: **Stop** (and now wait for the data to be offloaded)
6. Browse to a location you want to save the files, and then click **Save.** It will save as a *hobo file* (e.g. week1_5006.hobo).

7. CHECKING YOUR DATA

You should always check each of your files... because there will be errors periodically!

The values are approximate... they are for visual confirmation that your HOBO recorded correctly. There will likely be some in between values, if the values are opposite, the HOBO might have been applied backwards, or if they are all off by a specific value at some point, or it may have slipped off of horizontal or vertical placement.

HORIZONTAL ATTACHMENT: Y & Z-axis

VERTICAL ATTACHMENT: X & Z-axis

HORIZONTAL ATTACHMENT (Cows)
1. After saving your hobo file, you will be prompted to plot the data: Select the **Y & Z axis** and leave the other options checked.

2. You will see a plot similar to this....
 	
Y-axis values (approximate):
    Standing: -0.9 to -1.2 values
    Lying: -0.1 – 0.2 values
 	
Z-axis values:
    Right side: positive values (when y-axis is indicating lying)
    Left side: negative values (when y-axis is indicating lying)
 	
EXAMPLE: The red circle indicates a transition from lying on the left side to standing.

VERTICAL ATTACHMENT (Calves and Goats)
1. After saving your hobo file, you will be prompted to plot the data: Select the **X & Z axis** and leave the other options checked.

2. You will see a plot similar to this....

X-axis values (approximate):
       Standing: -0.9 to -1.2 values
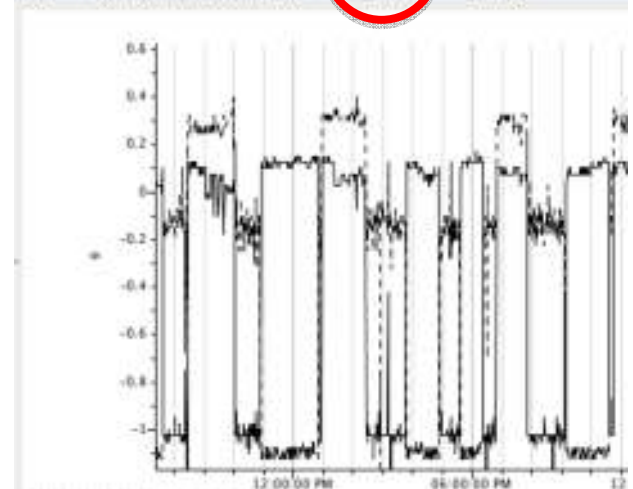
       Lying: -0.1 – 0.2 values

Z-axis values:
       Right side: positive values (when y-axis is indicating lying)

       Left side: negative values (when y-axis is indicating lying)

EXAMPLE: The red circle indicates a transition from standing to lying on the left side.

#	Time, GMT-04:00	X Accel, g	Z Accel, g	Cou
772	11/02/12 04:36:47 AM	-1.025	0.050	
773	11/02/12 04:37:47 AM	-1.025	0.175	
774	11/02/12 04:38:47 AM	0.025	-0.825	
775	11/02/12 04:39:47 AM	0.05	-0.775	
776	11/02/12 04:40:47 AM	0.050	-0.775	
777	11/02/12 04:41:47 AM	0.050	-0.775	
778	11/02/12 04:42:47 AM	0.050	-0.775	
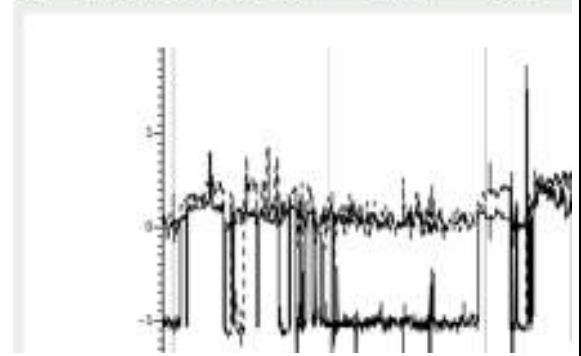
ERRORS

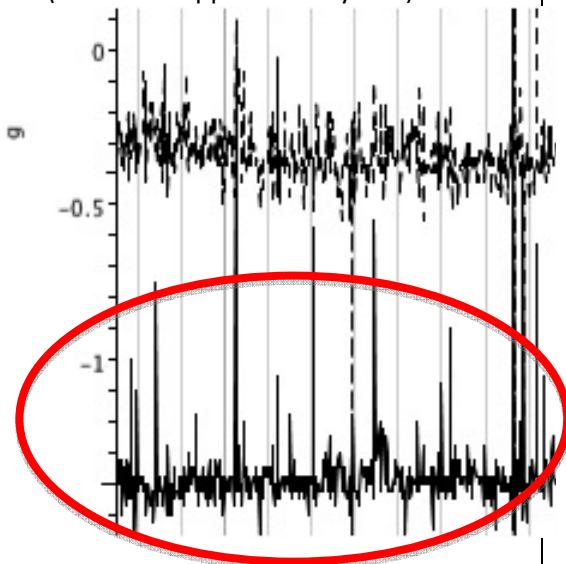You may run into all sort of errors (hopefuly not!), but the most common errors you'll see is if the HOBO slipped out of position (example 1) or if it falls off entirely (example 2).

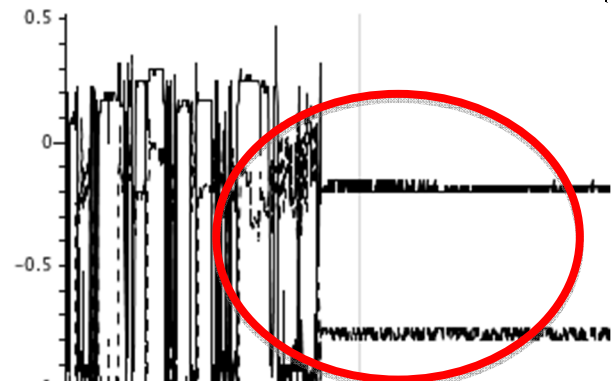**Example 1:**
The axis are shifted. So in this case, the goat was standing, but the values were all around -1.5 (instead of approximately -1.0).

Example 2:
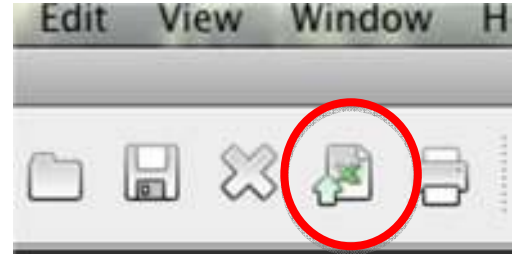The X (or Y) and Z – axis remain in one spot for an extend period of time.

8. SAVING DATA AS EXCEL

1. Once you are done checking your files, you can save them as Excel files for working with in SAS or Excel macros.

2. With you file open and plotted, just click the Export Table Data button.

3. Browse to a location you want to save the files, and then click **Save.** It will save as an xls file(e.g. week1_5006.xls).

9. SUMMARIZING LYING BEHAVIOR USING THE SAS CODE

The SAS code below will:

1. Import all the csv files saved in the same folder, append them one after the other, and take the cow number from the file name to create a new column with the cow number (File name will have to end with underscore and the cow number)
2. Apply David Ledgewood's algorithms (Journal of Dairy Science 93: 5129-5139) for lying/standing bouts and laterality.
3. Correct for single (and double) events (bouts that are 1 or 2-reading long)
4. Summarize the data by date and by hour, without splitting bouts at midnight or at the end of the hour.

NOTE: Familiarity with SAS is highly recommended before running the code. Please read the code and the green comments before running the code as you might need to make modifications to meet your needs.

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For questions please contact Dr. Marina von Keyserlink (nina@mail.ubc.ca) or Dan Weary (danweary@mail.ubc.ca)

```
***************************************************************************;
*CODE TO GET STANDING BEHAVIOUR AND LYING BEHAVIOR ON EACH SIDE BY DAY AND HOUR*
***************************************************************************;

(THIS CODE IS AN EXAMPLE THAT CAN BE ADJUSTED)

*CODE CREATED BY NURIA CHAPINAL;

*THIS EXAMPLE CODE CAN ONLY BE USED UNDER THESE CONDITIONS:

        *HOBO ATTACHED HORIZONTALLY, WITH THE AXES ORIENTED AS DESCRIBED IN THIS
        SOP(see comment in the "import data" section for vertical attachment);

        *READING FREQUENCY: 1/MIN (code can be easily modified for other reading
        frequencies);

        *PLOT TITLE (FILE NAME GIVEN AT LAUNCHING): XXXX_COWNUMBER
        (EX:  G2_WK1_3728);

        *DATE AND TIME FORMAT: 07/30/10 07:00:00 AM (see comments in the "import
        data" section to change date format from mmddyy to ddmmyy;

        *Y AND Z ACCELERATION (IN G UNITS) HAVE BEEN DOWNLOADED (BUT NOT X);

        *IN SUMMARY, CSV FILES WILL LOOK LIKE THIS:

        Plot Title: G2_WK1_3728
        #     Date Time, GMT-04:00    Y Accel, g  Z Accel, g
        1     07/30/10 07:00:00  AM  -1.025      -0.125
        2     07/30/10 07:01:00  AM  -0.975       0.125
        3     07/30/10 07:02:00  AM  -1.025      -0.025
        4     07/30/10 07:03:00  AM  -1.025      -0.025

* IF ANY OF THESE CONDITIONS IS DIFFERENT IN YOUR CASE, YOU WILL HAVE TO MODIFY
THE SAS CODE ACCORDINGLY;

* VERY IMPORTANT: READ THE CODE AND THE GREEN COMMENTS BEFORE RUNNING THE CODE.
RUN ONE SECTION (CODE BETWEEN TWO "RUN" STATEMENTS) AT A TIME AND CHECK THE LOG
AND THE FILE GENERATED TO MAKE SURE THERE ARE NO ERRORS;
```

```sas
*******************************;
*IMPORT THE DATA***************;
*******************************;

*SPECIFY THE FOLDER WHERE ALL YOUR CSV FILES ARE SAVED;

%let dir=C:\Users\nuria\Projects\hobo;

FILENAME FIX TEMP;

data _null_;
  infile "&dir\*.csv" lrecl=1 recfm=f eov=eov;
  file fix ;
  input c1 $char1. ;
  if eov then put;
  eov=0;
  if c1 in ('0D'x,'0A'x) then put;
  else put c1 $char1. @;
run;


data nc;
  infile fix dlm=',' dsd truncover;
  length fileno 8 xx $200 cow 8 obs 8 dtx $22  date 8 time 8  y z  8 title $100 ;
  retain fileno cow title ;
  drop xx;
  informat time time12.;
  format time time12.;

  informat date mmddyy10.; *change to ddmmyy10. if needed;
  format date mmddyy10.; * change to ddmmyy10. if needed;

  input xx @ @1 ;
  if upcase(xx)=:'PLOT TITLE' then do;
    if title ne xx then fileno+1;
    title=xx;
    cow=scan(title,-1,'_');
    delete;
  end;
  else if xx in ('#',' ') then delete;
  else input obs dtx y z;

  date=input(scan(dtx,1,' '),mmddyy10.); *change to ddmmyy10. if needed;
  time=input(scan(dtx,2,' ')||scan(dtx,3,' '),time12.);

  if y=. then delete; *Delete garbage rows with missing y and z values;

  drop dtx title ;
  run;
```

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```
/* IF HOBO WAS ATTACHED VERTICALLY, BUT YOU DOWNLOADED ONLY AXIS X AND Z, THEN
THIS CODE WILL WORK TOO (THE X COLUMN WILL BE LABELLED "Y" WHEN IMPORTED)*/

************************************************************
*DAVID LEDGERWOOD'S ALGORITHMS AND CORRECTIONS************
************************************************************;

data nc2;
set nc;
date = datepart(datetime);*creates a column with the date only;
hour = hour(datetime);*creates a column with the hour only (from 0 to 23,
important for diurnal patters);
format date date9.;

/*date can be changed to start at a different time of the day;
for example, if you want the experimental day to start at 9 am, add this
statement:

if hour > 8 then date2 = date;
else date2 = date-1;

then replace date for date2 in the rest of the code*/

*Aplication of David's algorithm to convert every reading into standing (1, a 1
looks like a person standing) or lying;

y= y+3.2;
z = z+3.2;
if y < 2.55 then ST=1; else ST=0;
run;

*Correction on ST column first, before assigning a side - because we believe
bouts that are 1-min long (or 2-min long) are likely to be recording errors;

data nc2;
set nc2;
by cow st notsorted;
if first.st then do;
bout+1;
duration = 0;
end;
duration + 1;
run;

data n ( rename = (duration = length));
set nc2;
by bout;
*if last.bout and duration le 2 then output; * find single and double
observations to correct for them;
if last.bout and duration le 1 then output;*find only single observations;
keep bout duration;
run;

*if a sequence looks like these 0001010000, it won't be properly corrected (we
had the same problem with the old macro, but it will be corrected later when we
correct for single values in laterality;
```

```
data nc3;
merge nc2 n;
by bout;
if length = . then return;
if st = 0 then newst = 1;
else newst = 0;
run;;

data nc3;
set nc3;
if newst=. then stcor=st; else stcor=newst;
drop bout duration length  newst;
run;

*ST is the original column, stcor is standing behavior after correction for
single or double events (short bouts);

*Laterality;

data nc4;
set nc3;
if stcor=0 then do;
if z < 3.025 then SIDE=0; else SIDE=1;
end;
*0 means right, 1 means left;
run;

data nc4;
set nc4;
by cow side notsorted;
if first.side then do;
bout+1;
duration = 0;
end;
duration + 1;
run;

data n ( rename = (duration = length));
set nc4;
by bout;
*if last.bout and duration le 2 then output; * corrects for single and double
observations;
if last.bout and duration le 1 then output;* corrects for single obs only;
keep bout duration;
run;
```

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```
Data nc5;
merge nc4 n;
by bout;
run;

*this will correct single standing/lying values that did not get corrected before
due to tricky sequences such as 0001010101111;

data nc5;
set nc5;
side2=lag(side);
if length = 1 then do;
if side =. then newside = side2;
if side = 1 then newside = 0;
if side=0 then  newside=1;
end;
drop side2;
run;

data nc5;
set nc5;
if newside=. then sidecor=side; else sidecor=newside;
drop bout duration length  newside;
run;

data nc6;
set nc5;
if sidecor=. then type=1; *this will correct single standing/lying values that
did not get corrected before due to tricky sequences such as 0001010101111;
if sidecor=0 then type=2;
if sidecor=1 then type=3;

*type=1 means standing bout(1 reminds me of a man standing);
*type=2 means lying on right side;
*type=3 means lying on left side;

run;

*new bout_id, now considering 3 kind of bouts;
data nc6;
set nc6;
by cow  type notsorted;
if first.type then bout_id+1;
run;
```

```
********************************;
*SUMMARY BY DAY*****************;
********************************;

proc summary data=nc6 nway;
where type=1; *keep only standing time;
class cow date;
output out=stime ;
run;
*_freq_ would be standing time in minutes, 1440-time= lying time in minutes;
*no need to add any var statement for this purpose;

data stime;
set stime;
rename _freq_= stime;
drop _type_;
run;

proc summary data=nc6 nway;
where type =2; *keep only lying time on the right side;
class cow date ;
output out=rtime ;
run;

data rtime;
set rtime;
rename _freq_= rtime;
drop _type_;
run;

proc summary data=nc6 nway;
where type =3; *keep only lying time on the left side;
class cow date ;
output out=ltime;
run;

data ltime;
set ltime;
rename _freq_= ltime;
drop _type_;
run;
```

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```
*number of bouts and duration;

*proc summary again to get each bout duration, and initial and final bout time;
*in this way, the bout won't be split at the end of each hour, or at midnight;
*we will actually get number of bouts "started" on each date;

proc summary data= nc6 nway;
class cow  type bout_id;
var date hour;
output out=nc7  (drop=_:) n=dur idgroup(out (date hour) = idate ihour)
idgroup (last out(date hour) = fdate fhour);
run;
*dur: duration of each bout;
*idate: date when bout was initiated;
*ihour: hour when bout was initiated;
*fdate and fhour, just in case, but won't be used in the remaining code;


*some bouts did not get corrected, so I won't consider them for bout counting, I
will delete them;
data nc7;
set nc7;
if dur =1 then delete;
run;

proc summary data=nc7 nway;*take the dataset from the previous proc summary to
get bout dur;
where type=1; *keep only standing bouts;
class cow idate;
var dur;
output out=sbouts (drop=_:) mean=sdur n=sbouts;
run;

proc summary data=nc7 nway;*take the dataset from the previous proc summary to
get bout dur;
where type=2; *keep only lying bouts on right side;
class cow idate;
var dur;
output out=rbouts (drop=_:) mean=rdur n=rbouts;
run;

proc summary data=nc7 nway;
where type=3 ; *keep only lying bouts on left side;
class cow idate;
var dur;
output out=lbouts (drop=_:) mean=ldur n=lbouts;
run;

proc summary data=nc7 nway;
where type ge 2 ; *keep  lying bouts on both sides;
class cow idate;
var dur;
output out=lyingbouts (drop=_:) mean=lyingdur n=lyingbouts;
run;
```

```
*all information together;

data sbouts;
set sbouts;
rename idate=date;

data lbouts;
set lbouts;
rename idate=date;

data rbouts;
set rbouts;
rename idate=date;

data lyingbouts;
set lyingbouts;
rename idate=date;
run;

proc sort data=stime;
by cow date;
proc sort data=rtime;
by cow date;
proc sort data=ltime;
by cow date;
proc sort data= lbouts;
by cow date;
proc sort data= sbouts;
by cow date;
proc sort data=rbouts;
by cow date;
proc sort data=lyingbouts;
by cow date;

data allday;
merge stime sbouts rtime rbouts ltime lbouts lyingbouts;
by cow date;
run;

data allday;
set allday;
if stime=. then stime=0;
if rtime=. then rtime=0;
if ltime=. then ltime=0;

if sbouts=. then sbouts=0;
if rbouts=. then rbouts=0;
if lbouts=. then lbouts=0;

lyingtime= rtime+ltime;
total = stime + rtime+ ltime;*it has to be 1440;
run;
```

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For questions please contact Dr. Marina von Keyserlink (nina@mail.ubc.ca) or Dan Weary (danweary@mail.ubc.ca)

```sas
data allday2;
set allday;
if total <1440 then delete; *it gets rid of incomplete days;
run;

*stime = standing time;
*sbouts= standing bouts;
*sdur=mean standing bout duration;

*rtime = lying time on the right side;
*rbouts= lying bouts on the right side;
*rdur=mean lying bout duration on the right side;

*ltime = lying time on the left side;
*lbouts= lying bouts on the left side;
*ldur=mean lying bout duration on the left side;


*lyingtime = lying time on both sides;
*lyingbouts= lying bouts on both sides;
*lyingdur=mean lying bout duration on both sides;

*Final files:

*allday: all dates are kept;
*allday2: only complete dates are kept;
*choose the one you need;

proc export data=allday2
    outfile='C:\Users\nuria\Desktop\allday2.csv'
    dbms=csv
    replace; *choose the path were you want to save your dataset, and a name for
the file with extension csv;
run;

*REMEMBER YOU NEED 3 DAYS OF DATA TO PROPERLY ESTIMATE LYING BEHAVIOR;
*ITO ET AL. 2009. JOURNAL OF DAIRY SCIENCE 92: 4412-4420;
```

```
******************************************;
*SUMMARY BY HOUR************************;
******************************************;

*BECAUSE OF THE NORMAL RANGE OF LYING AND STANDING BOUT DURATIONS, IT DOES NOT
MAKE SENSE TO CALCULATE THE FREQUENCY
OF BOUTS INITIATED BY HOUR;
*HOWEVER, THE CODE CAN BE EASILY MODIFIED TO SUMMARIZE DATA BY LONGERS PERIODS
WITHIN A DAY, FOR INSTANCE, DAY AND NIGHT, OR 4-H PERIODS;

proc summary data=nc6 nway;
where type=1; *keep only standing time;
class cow date hour;
output out=stime ;
run;
*_freq_ would be standing time in minutes, 1440-time= lying time in minutes;
*no need to add any var statement for this purpose;

data stime;
set stime;
rename _freq_ = stime;
drop _type_;
run;

proc summary data=nc6 nway;
where type =2; *keep only lying time on the right side;
class cow date hour ;
output out=rtime ;
run;

data rtime;
set rtime;
rename _freq_ = rtime;
drop _type_;
run;

proc summary data=nc6 nway;
where type =3; *keep only lying time on the left side;
class cow date hour ;
output out=ltime;
run;

data ltime;
set ltime;
rename _freq_ = ltime;
drop _type_;
run;

proc sort data=stime;
by cow date hour;
proc sort data=rtime;
by cow date hour;
```

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```sas
proc sort data=ltime;
by cow date hour;


data allhour;
merge stime rtime  ltime ;
by cow date hour;
run;

data allhour;
set allhour;
if stime=. then stime=0;
if rtime=. then rtime=0;
if ltime=. then ltime=0;
lyingtime= rtime+ltime;
total = stime + rtime+ ltime;*it has to be 60 if recording freq is 1/min;
if total <60 then delete; *delete incomplete hours (incomplete hours might happen
at the beginning and at the end, and you may want to delete the whole incomplete
day - see below);
run;


*Delete incomplete days (if you need to);
data incompletedays;
set allday;
where total<1440;
incdays=1;
keep cow date incdays;

data allhour2;
merge allhour incompletedays;
by cow date;
if incdays=1 then delete;
drop incdays;
run;

*Final files:

*allhour: all dates are kept;
*allhour2: only complete dates are kept;
*choose the one you need;

proc export data=allhour2
   outfile='C:\Users\nuria\Desktop\allhour2.csv'
   dbms=csv
   replace; *choose the path were you want to save your dataset, and a name for
the file with extension csv;
run;
```

LOGGER MANUALS AND CONTACT

Product info:

http://www.onsetcomp.com/products/data-loggers/ua-004-64

Manual:

http://www.onsetcomp.com/files/manual_pdfs/10872_A_MAN_UA_004.pdf

Contact Hoskin Scientific Ltd. (HOBO distributor in Canada):

Sales - Rod McKeown (RMcKeown@hoskin.ca)

Repair – Dana Yoneda (dyoneda@hoskin.ca)

Website - www.hoskin.ca

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