Biomass Daily System
User Manual

www.biomassdaily.com

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We wish you good luck with Biomass Daily

We at Pentair Aquatic Systems thank you for choosing Vaki Biomass Daily.

VAKI Biomass Daily has been developed in collaboration with some of the world's largest aquaculture companies over 32 years.

The system works in the form of a frame containing LEDs that transmit infrared light rays both horizontal and vertical planes. These light rays are broken when the fish swims through the frame and a shadow image of the fish is drawn regardless of the light conditions around the frame. This picture measures the height and length and is used to calculate the weight of the fish and the K factor. The measurements are transmitted to a cloud based database and become accessible through the BiomassDaily web site.

In this manual, we will provide an introduction to how VAKI Biomass Daily is used.

If you have questions or need help, please contact VAKI by email (service.is@pentair.com) or phone (+3545953000)

1 Online dashboard and reporting program - Biomassdaily.com

Biomassdaily.com is a unique tool that provides the user with accurate information about average weight, size distribution, daily growth and general condition in all grades without much effort. However, it is important to be able to read and interpret data for best results. This manual provides an introduction to how Biomassdaily.com is used. Keep in mind that all settings and changes you make in the program will in no way change the basic data stored on the server, no data will be deleted or changed.

1.1 Dashboard

By logging in to www.biomassdaily.com, the main screen will open, giving an overview of functionality and growth in all the cages/frames on a farm. Each coloured tab represents a population.
From the black menu strip at the is there an access to various reports about the state of the populations and measurements.
Below we describe the sections of the dashboard view (the red (encircled) letters) – and further down we will walk to the available options from the menu
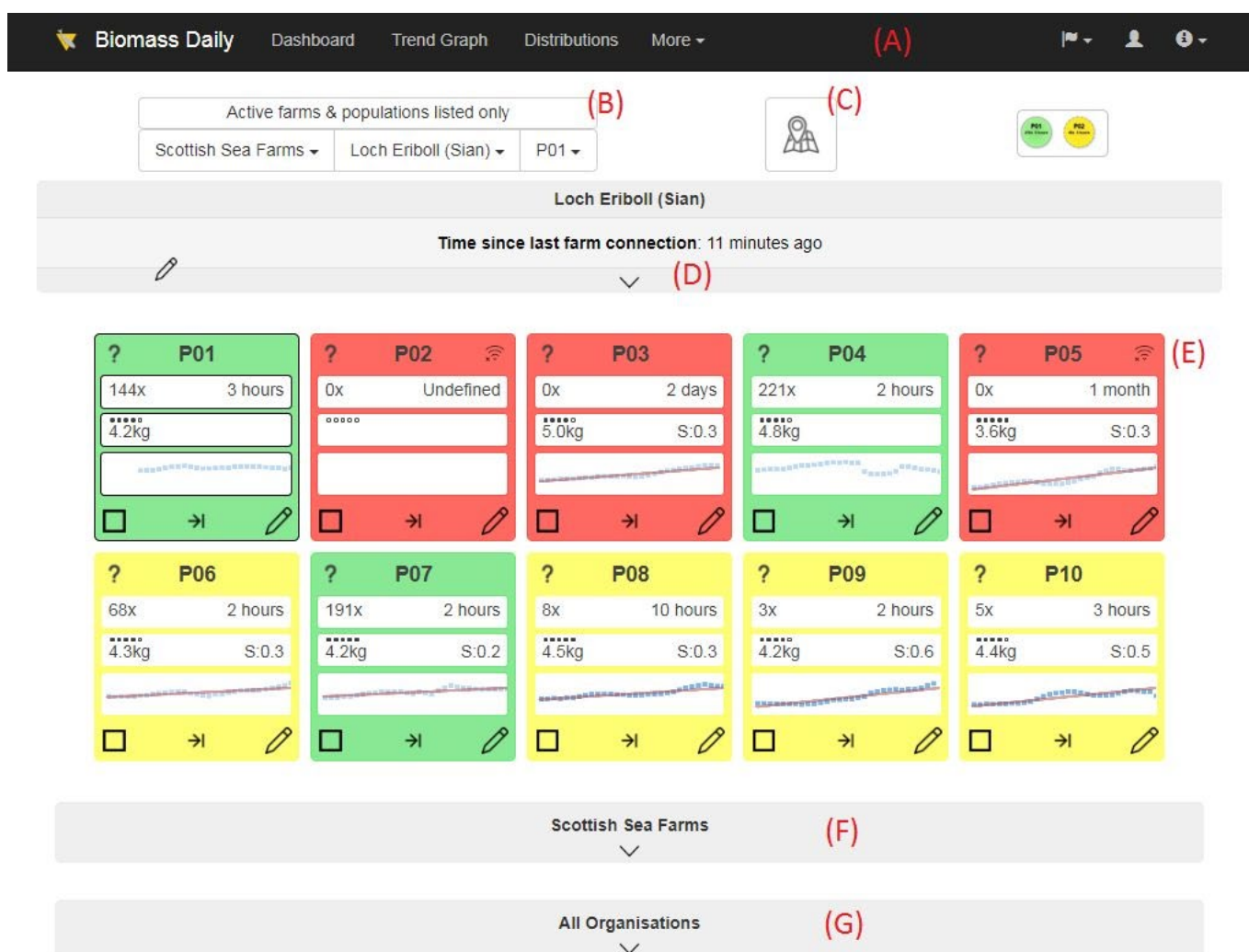

Figure 1 BiomassDaily Dasboard page

A) The menu strip – access to various views on growth data and functionality

B) The population picker – you see this picker on many of the reporting pages. Select population of interest – or farm or organisation if you have access to more than one (further below)

C) Button to bring up map which shows location of all farms belonging to selected organization(/company)

D) Information about the farm. Communication status and by clicking the down arrow we open up access to contact information on farm (given if it has been registered). Notice the line which tells about latest communications to the farm. If time exceeds some limit – the line appear red – as an error/warning status.

E) The blocks/tabs represent the individual populations. For details about the fields and color-codes, click on the question mark in the upper left corner on any of the blocks

F) Click the down arrow to get an overview of all farms belonging to current organization. It will show the colour codes of every population

G) If user has access to multiple organizations, an overview of them all can be displayed here under.
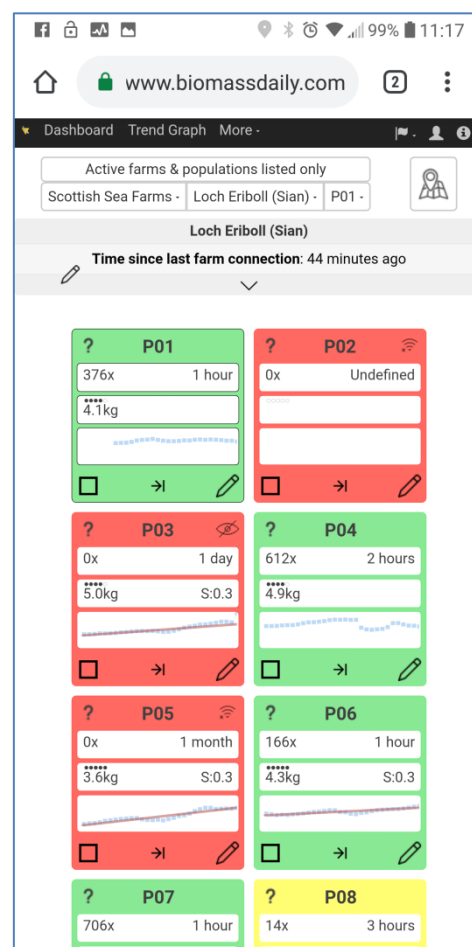
Figure 2 Dashboard page - displayed on mobile device

1.1.1 Menu
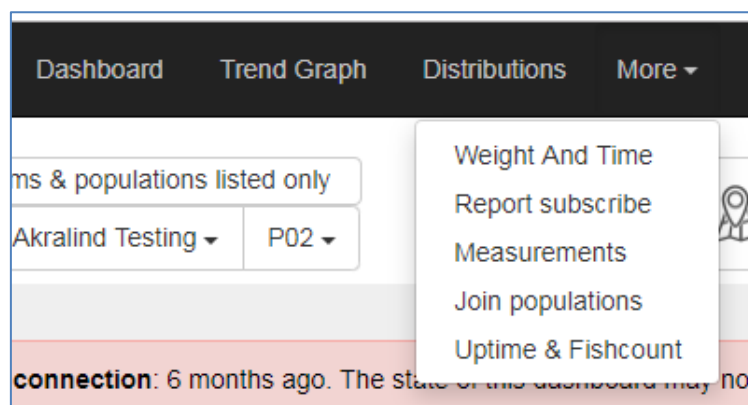
Figure 3 Menu options

Currently there are 8 menu options accessible to the general user of BiomassDaily. They are all described in the following sections. If the width of the screen is enough, 4 options will appear in the black horizontal strip and the remaining ones in the vertical dropdown list under the <*More…*> option.

On the right part of the menu strip, there are other 3 options:
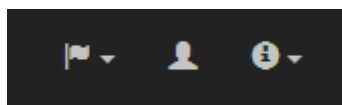
From left:

- Language selector: Possibility to choose between English, Norwegian and Spanish.
- User options:
  Log out from site
  Change password
  A few user preferences for the appearance and functionality of the site
- Access to information and manuals

1.1.2 PopulationPicker

If user has access to multiple organizations or farms he can choose between them in the two leftmost fields in the lower line in the picker. In the rightmost field the population of interest is selected.
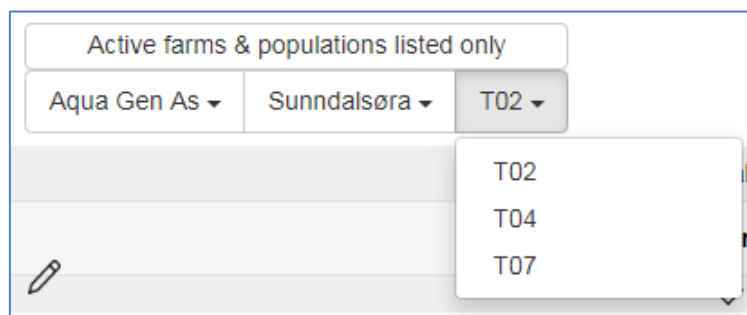
Figure 4 Population picker

When the topmost button shows: "Active farms & populations listed only", only currently active populations will appear in the drop down list.   By clicking the topmost button, it will toggle to: "All farms and populations listed" and all available population data (from earlier times also) will show up in the dropdown list:

When all available populations are listed in the picker, the population entries will appear like this. Its name first, then (Starting month/Starting year).

The older inactive populations will not show up on the dashboard, but they can be viewed in for ex. The trendgraph and the distribution pages. Keep in minf though, that appropriate dates must be selected for the in active populatinos.

1.2 Trend Graph

Here you can see the history of the measurements over a chosen period. This page is largely used to determine the growth rate over the selected period and average weight at the end of the period.

Each column in the chart represents the number of fish measured that day. The blue dots show average weight for that day, then based on the measurements that day, two days before and two days after. A so-called «rolling average». Graphs for temperature, depth of frame, and condition factor that day are shown in the same chart. The trend line is a "best line" drawn through the blue dots, which shows the growth rate based on measured fish in the chosen period. SGR, specific growth rate, is based on this line, showing percentage growth per day, as shown 0.44% per day. Final weight is the end point of the trend line, and after a period of much measured fish and good mixing, this can be a good estimate of actual average weight in the cage.
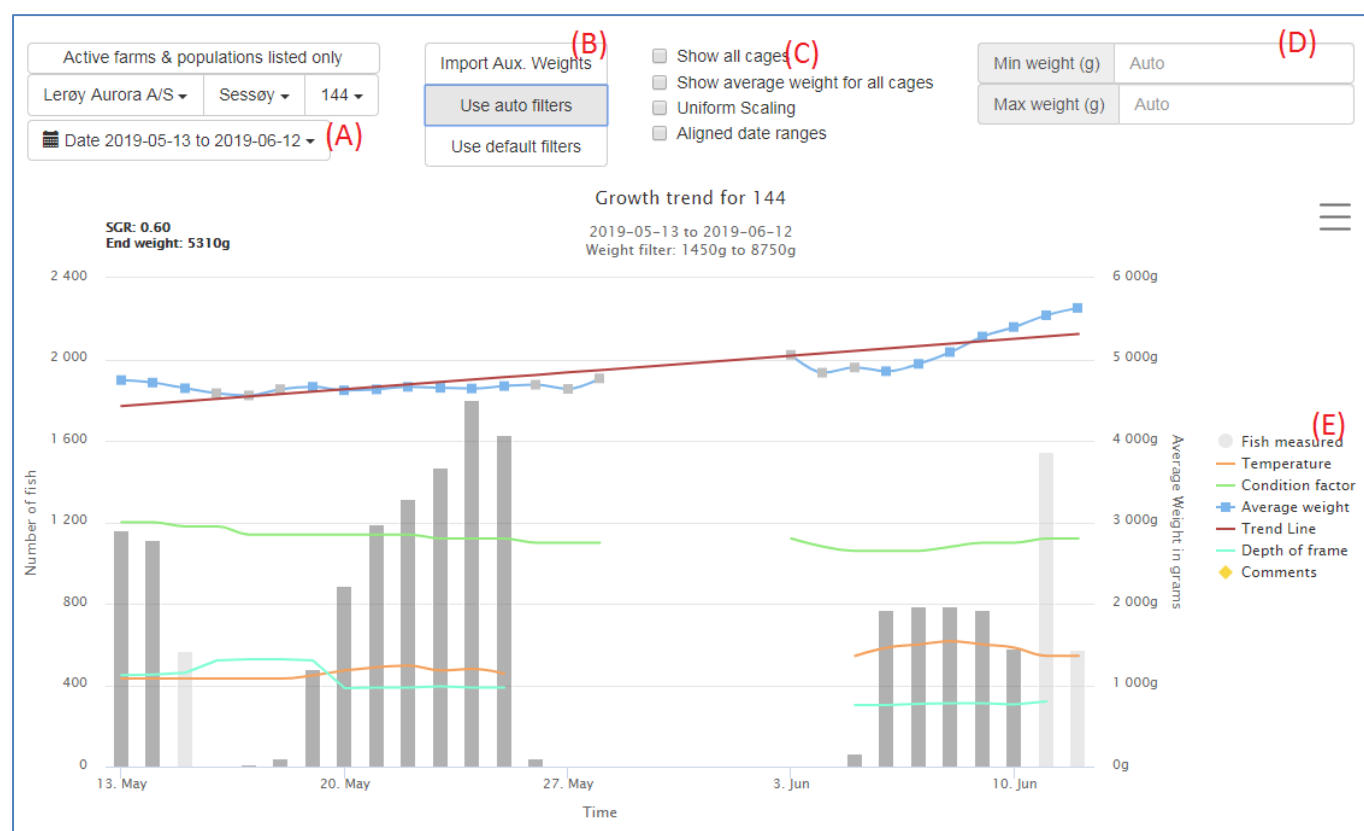
Figure 5 Trend graph page

A) Date range picker. Click on the field to either select some custom daterange or one of the predefined fixed date-ranges that will appear
B) Button options:
   <Import Aux. Weights>: Given the user has a file with weights pr/day from some external source, the data can be uploaded and plotted on the trend graph for comparison. The dates in this external source must be within the date range used for the graph
   <Use auto filters>: The pool of measurements may include some weights which are too low or high to be of interest. Might for example belong to an alien population in the cage. By clicking this button, an automatic algorithm is used to find some max/min weights of interest based on available data

\<Use Default Filters\>: The min/max weights are set to a predefined values. Min weight = 100g, Max weight = 13kg.

C) CheckBox options:

\<Show all cages\>: If checked, trend graph for every active population on the farm is displayed on tha page. If not, only the graph for the population selected in the population picker is displayed

\<Show average weight for all cages\>: If checked, the average weights lines for every population is drawn on one single chart – for better comparison

\<Uniform scaling\>:   When displaying multiple charts, the scale on the Y-axis is everywhere the same

\<Aligned date ranges\>: If checked, the date range on each chart will be identical.

D) The Min/Max weights filter can be edited manually here

E) Data series labels. Click a label to toggle the visibility of that given line on and off

1.3. Distributions

By either pressing "Distributions" or by pressing one of the days in the diagram, you will see this page. Here is the distribution of weight classes and condition factor on live or slipped fish, both in bar charts and in tabular form. Again, the selection is based on a five-day rolling average.

| Date 2018-11-29 ▾ | | Min weight (g) | 100 | | Min CF | 0.9 | | Gutting factor (%) | 0 |
| Bin Size (g) | 1000 | Max weight (g) | 13000 | | Max CF | 2 | | Population size | 0 |

Aqua Gen As / Aquagen Ørsta / v13 .

Sample date:	2018-11-29.	Min weight:	100g	Avg. CF:	1.48
Sample size:	635	Max weight:	13 000g	Gutting factor:	0%
Avg. live weight:	8 628g	Min CF:	0.9	Population size:	0
CV:	0.19	Max CF:	2	Excluded fish:	2
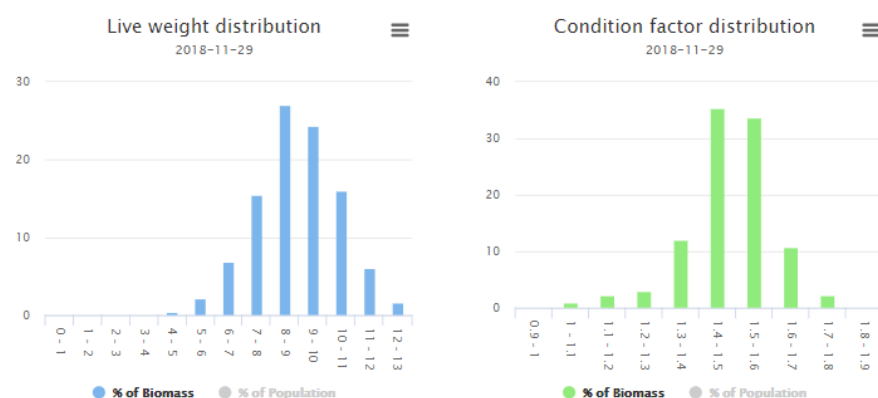
Bin size (kg)	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	11 - 12	12 - 13
% of Biomass	0.02	0.15	0	0	0.34	2.19	6.86	15.45	27.03	24.31	16.05	6.02	1.57
% of Population	0.16	1.1	0	0	0.63	3.31	8.98	17.48	27.4	22.05	13.23	4.57	1.1
Kg													
Count													

Figure 6 Distribution page

"Min / Max weight" and "Min / Max CF" are used to exclude measured fish below or above these limits, as in Trend graph. Min weight is the most important thing to note since small fish can have a big impact on the average weight of large fish if they swim in large quantities through the measuring frame. Max weight and min / max condition factor are used to exclude fish-like shadows that are formed when two fish swim simultaneously through the frame and in a few cases the shadow is not automatically rejected by the software. In the "Bin Size" field, select the weight classes to which you want to divide the sample. If you know the gutting factor, you can add this to "Gutting factor%" to calculate gutted weight, and in "Population size" you can enter the number of fish in the cage to calculate total biomass and number / biomass within different weight groups. "Excluded fish" shows how many fish are removed from the selection based on the selected limit values. CV or coefficient of variation is the standard deviation divided by the average weight. The more uneven the fish in the sample is, and the wider the size distribution curve is, the higher the CV. A population that has been left alone for a long time without disease or sorting will essentially get an approximately normalized curve. A newly sorted population will mainly have a larger percentage overall about a few weight classes. A population that has had disease and poor growth will often have a center of gravity in the lower weight classes. If the distribution curve deviates a lot from what is expected, one must assess whether one considers representative fish to be measured. Please contact VAKI.

1.4 Weight and time

The "Weight and Time" page shows the size of each fish and when the fish was measured during a day, for a selected period. Each blue-colored point represents a fish, position on the X-axis shows time and position on the Y-axis shows weight. This chart is useful, among other things, to identify subpopulations of taperfish or sei / purse fish which can then be seen as separate clusters (see the inversion), which can then be excluded by selecting limit values. In addition, you can identify times of day when there is a lot of or especially little fish going through the frame. The yellow   diamonds   are   average   weights   pr/day. Notice that the first days on the chart there seems to be few measurements of "normal" weights but some population of small fish. The last two days the small fish seems to mostly disappear and we are having good number of   measurements. By clicking the "Depth" in the label area below the chart, the depth measurements on the frame will be displayed as green diamonds (given some depth measurements are available).   Can be usable to find out if the measurements change by depth of the frame in the cage

In this chart, all measurements are displayed, but the Min/Max weights filter is represented with red lines – such that if we are using this filter values in the trend graph, all measurements below the lower red line and above the upper one would be skipped.
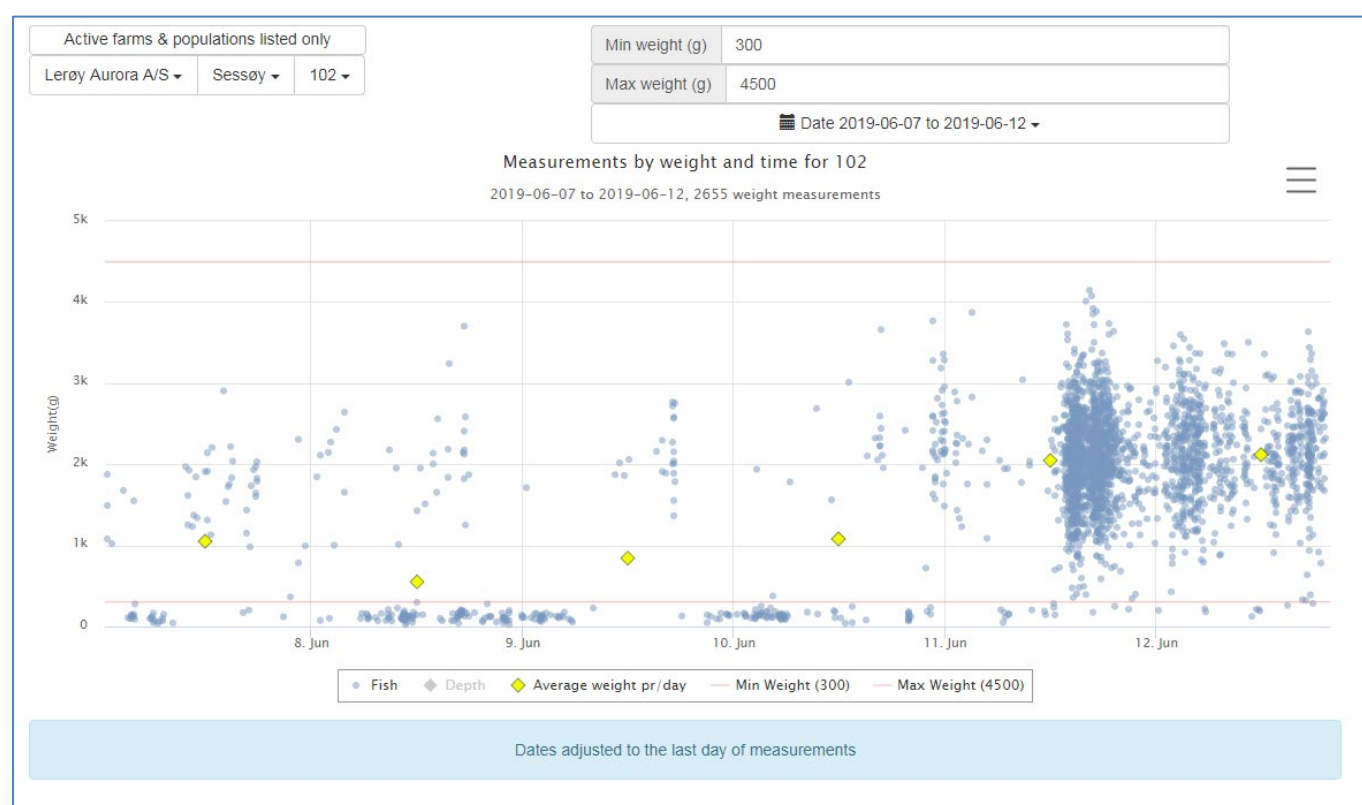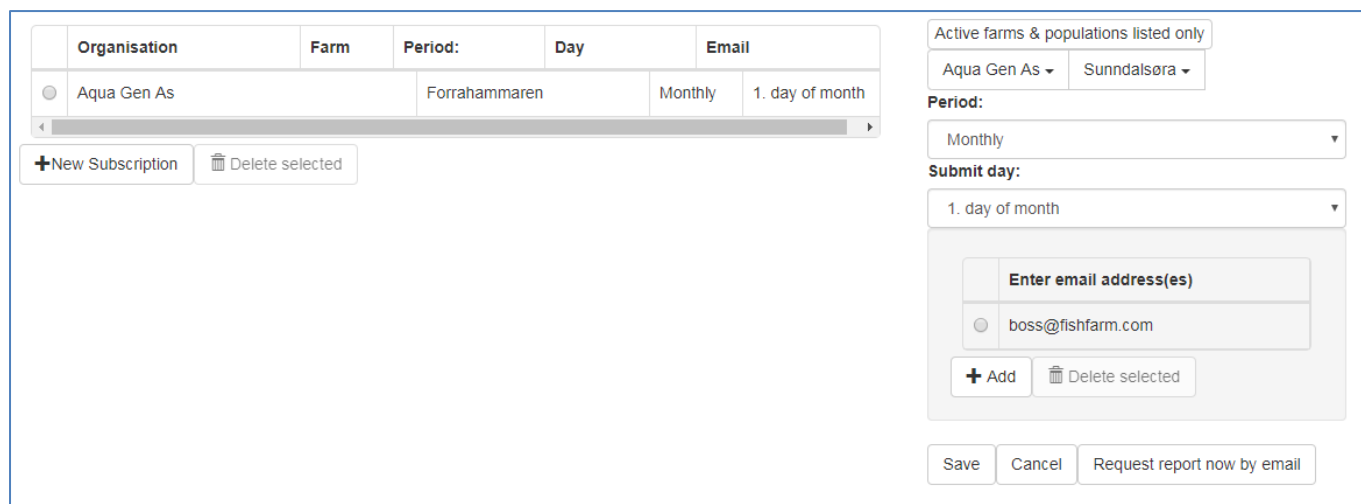

Figure 7 Weight & time page

1.5 Report subscribe

You can start a subscription – such that weekly or monthly a pdf report will be generated by the server and file will be sent automatically to an email address that you specify. The Min/Max weight filters used are the default ones (100g/13kg).

Figure 8 Report subscribe page

In the example above, there is already a subscription on one farm and we are creating a subscription to another farm. To add a subscription:

- Press *<+New Subscription>* which will bring up the form on the right.
- Then press *<+Add>* button to add a receiving email address
- Select period and submit date
- *<Save>*

Deleting /stop a subscription is done in the form on left. Select the subscription to delete – and press *<Delete selected>*

To test this functionality, register a email address in form on right and press *<Request report now by email>*. You should receive a report on the mail within few seconds.

1.6 Measurements

An option to get individual measurements for a given population within a specified date range. The data will be displayed in a table on screen – and with a simple button click it will be written to a t file (format: .csv or .txt).

Figure 9 The fetch measurements page

The procedure to retrieve the measurements:

- Select the population of interest
- Select date range
- Press <*Fetch measurements*> and data will be downloaded.
- Press <*Write to file*> if you want to save data to your local system.

Note that if the number of measurement is high, this operation could take some time.

1.7 Join population

An option to view combined data from multible populations (from a single farm). Currently this combinations can only be viewed in the trengraphs.

A combined population will get the name on the form **[P01+P02]** – if it's the combination of populations **P01** and **P02**. The individual poulations (**P01** and **P02** in this case)will still be available in the population picker.

Scottish Sea Farms, Dunstaffnage

Select the populations to be joined from the table and click on the button below:

Population
P01
P02
P03
P04
P05
P06
P07
P08
P09

Join selected

Select the joined population and click the delete button below

Population
[P01+P02]
[P02+P05]

Delete selected

Figure 10 Joining population page

No real data is modified when creating or deleting Joined populations. It's just an option for viewing.

1.8 Uptime & Fish count

This page is used to summarize the utilization of the frame for a selected period. The list shows active populations, total number of fish measured in the frame during the period, number of days when measured fish, number of days with connection to the frame and number of days with poor visibility in the frame. This gives a picture of how well the frame is utilized in the current population.
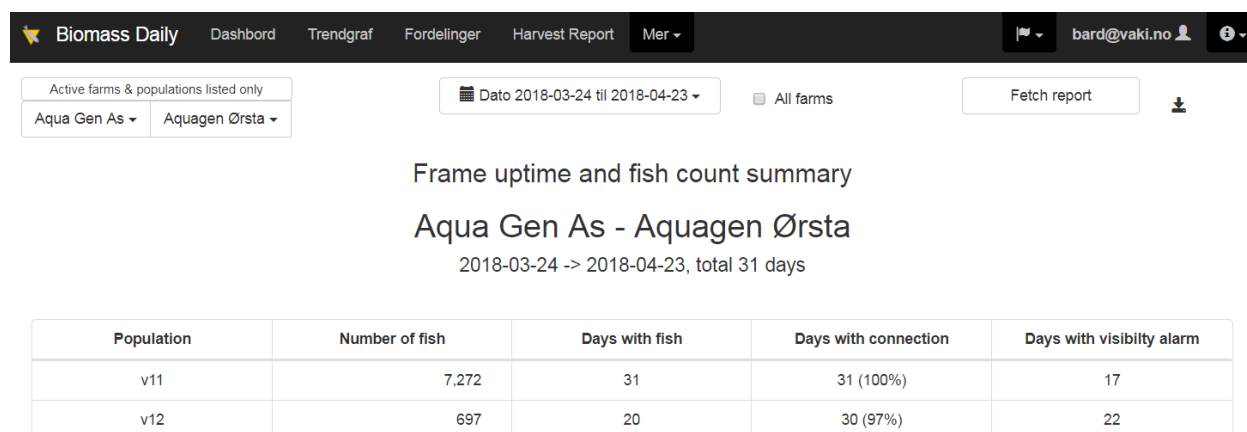

Population	Number of fish	Days with fish	Days with connection	Days with visibilty alarm
v11	7,272	31	31 (100%)	17
v12	697	20	30 (97%)	22

Figure 11 Uptime and fish count page

2 Statistical assumptions

Accurate information about the average weight of the fish, size distribution and growth is important in order to plan production and slaughter. But it's no easy task to measure the size of the fish in a farmyard. What is of the utmost importance for a good result is how many fish are included in a sample and how the collection is collected.

## 2.1 Statistics for single measurements

Population and selection are two key words in terms of statistics. The population is all fish that swim in the cage, while the sample is the fish that is measured. This applies regardless of whether you take manual sampling or measure the fish with a biomass meter. Simplified, you can say that if the sample represents the population, you can comment on all fish in the cage with good safety. Representativeness is how good the sample reflects the entire population. In order for the sample to be representative, there are especially two things of interest: size of the sample and that the selection is a good mix of all fish in the cage so that the entire population is reflected. As the size of the fish (longer since sorting) increases, you will need both more fish in the selection and it will be harder to achieve a good mix. One can take an example from a poll for the parliamentary elections. The population is all Norwegian voters, while the selection is the ones who are asked what to choose. The accuracy will be good if the selection is a good mix of women and men, from both north and south, among young and old, educated or not, city people and local people, etc. But if you ask 1000 young men in Finnmark what to choose, then there is a high likelihood that the results will be different than if you ask 1000 old ladies in Oslo. So the mixture is as important as the number.

2.2 The size of single measurement (selection)

But how big should the sample (snippet) be to achieve accurate measurements? For this question there is no clear answer, as the size of the sample depends on the population's standard deviation ie the size spread in the cage (if the fish is sorted or not). With increasing standard deviations (uneven fish), one needs larger selection. We can look at what statistical theory says if necessary size of the sample and run a strength analysis to find the required number of fish based on common statistical assumptions. These assumptions are normally distributed population, significance level of 0.05 and 90% probability. In other words, in nine out of ten measurements (90% probability) we want 95% security (significance level 0.05) to say that the measurements accuracy is greater than X%. It is important to note that these numbers apply to all measurement methods, regardless of whether the measurements are taken with biomass measurements, with manual measurements of the fish or otherwise. If we have a population (all fish in a cage) with an average weight of 3.0 kg and standard deviation of 1.2 then we need a sample of at least 9,600 fish in order to say with our assumptions that the measurement accuracy is over 99 %. If we want 97% accuracy then we need approx. 1,100 fish. For 95% accuracy, we need almost 400 fish, and if the sample is only 100 fish, one can not expect greater accuracy than 90%.

2.3 Fish size distribution

With uneven fish, standard deviations are greater. As shown in the example above with 3.0 kg average weight and 1.2 in standard deviation, 68% of the fish within +/- is a standard deviation from the incision, ie between 1.8 and 4.2 kg. 95% of the fish is within +/- two standard deviations from the average, ie 0.6-5.4 kg. If the fish is steady and the standard deviation is 0.8 then 68% of the fish is within 2.2 - 3.8 kg and 95% of the fish is within 1.4 - 4.6 kg.

Normal probability curve and
Standard deviations

68%

95%

-3o   -2o   -o   u   +o   +2o   +3o
AVERAGE
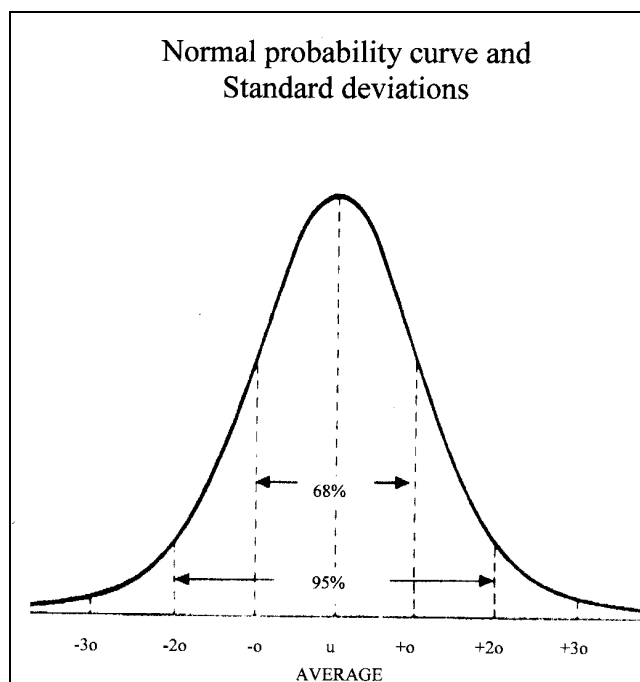
2.4 Get a good representative sample

As mentioned above, it is important to get a good mix of the fish by measurement. There are many factors that affect the behavior of the fish in the cage, such as temperature, light, time of day, oxygen level, weather, season, flow, disease, feeding, hunger, density, etc. It is therefore important that you pay attention to the behavior of the fish and manage to track down changes.

3 Biomass Daily - Safer Data

Biomass Daily is based on daily measurements in the cage for extended periods of time, and thus you have a completely different dataset than at random samples. The reason why Biomass Daily provides the safest data is as follows:

• Much larger number of fish being measured, since the frame is always in the cage

• Better representation of all fish in the cage, daytime rhythms are captured over time

• Historical data for a longer period of time allows you to detect patterns and deviations

• Ability to calculate percentage growth and real biological feed factor

3.1 Continuous measurements provide safer data

With Biomass Daily, the fish is measured continuously and data is collected over a long period of time. Thus it is possible to follow the growth curve, thus focusing on both feed factor and growth, whether it is in line with temperature, feeding and other conditions that affect the growth of the fish. Which of the two measurement data below would you trust?
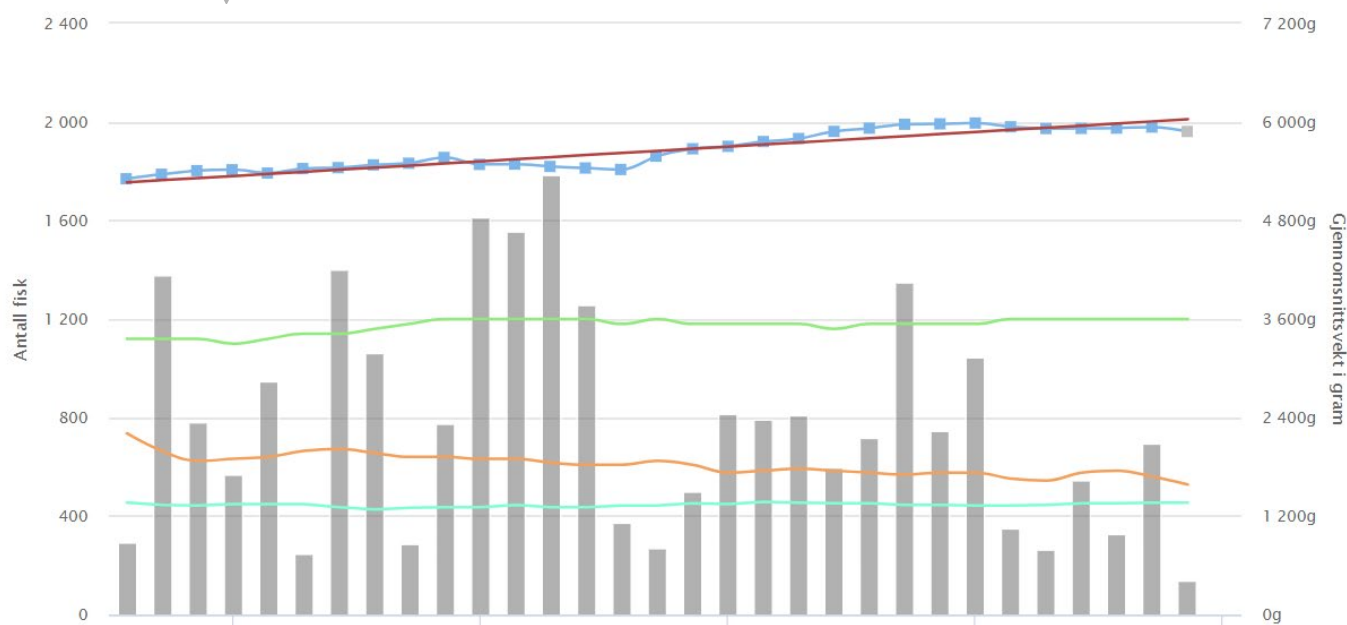
Daily measurements based on many thousand fish over a long period of steady, credible growth that are in line with the amount of food, temperature and fish size.
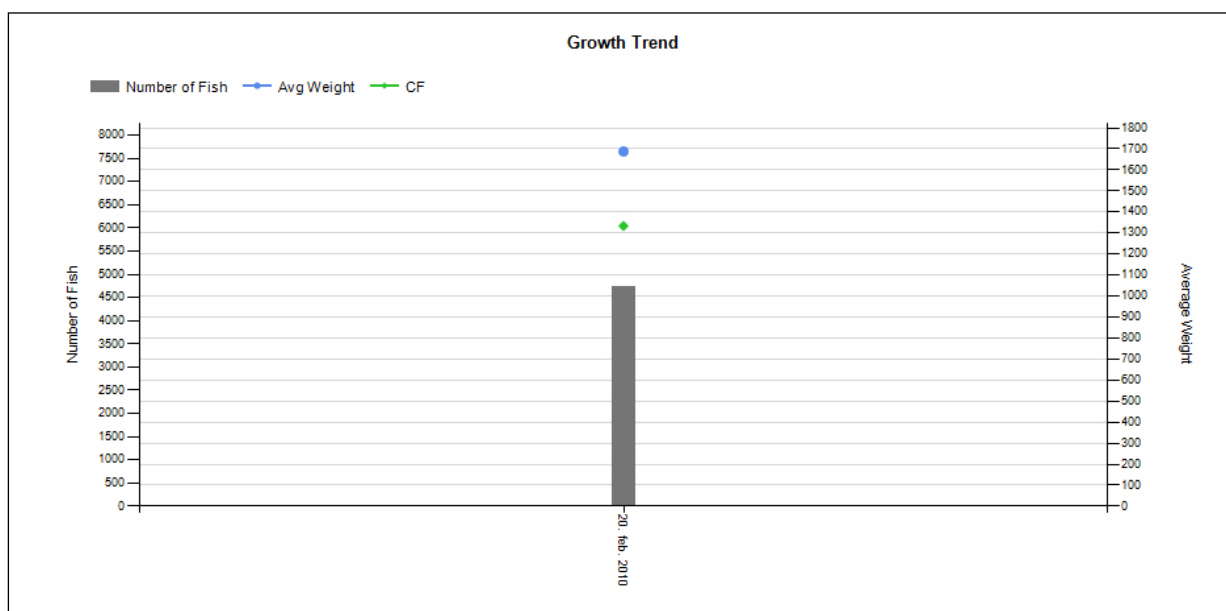
Or a single measurement, a point without a comparison basis.

Finally

The Biomass Daily first and foremost offers is a very large dataset about the user's own fishing groups, and a set of useful tools for processing this data. If you are most interested in the entry weight, the growth rate over a certain period of time, in the dynamics of weight classes, in periodic forefront ... Biomass Daily lays the foundation for the information you are looking for.

If you have technical questions or need help with theory and to interpret the data sets, do not hesitate to contact VAKI. We are ready to help you!

Good luck!