Accumulated thermal units (Degree days)

A large part of farming and animal health is benchmarked against time, for example judging an animals pregnancy period or a drug's withdrawal period. In traditional animal agriculture which makes use of mammals, judging days is relatively straight forward, but in the farming of ectotherms (such as fish). This can be slightly more complicated.

Counting the days for a biological system (such as an animal) is actually a proxy for calculating the progression of a biological system. This is usually a reliable method, as biological systems of endotherms (i.e., birds and mammals) is highly uniform and correlated closely with the passing of minutes, hour, and days. This is due to genetic instructions that are relatively uniform across individuals in a species, and a tightly controlled metabolic rate (a factor which can play a significant role in biological development).

In ectotherms the genetic instructions remain relatively uniform, but due to large variations in body temperature (compared to the homeostatic body temperature of endotherms), the metabolic rate of these animals can vary notably. This variance has effects on a multitude of biological processes, from development to growth to digestion and excretion. Thus, when considering and predicting biological progression one must factor in both the passage of time and the body temperature of the animal over the period of time. Fish farmers make use of the concept of the accumulated thermal, also known as the degree day.

The accumulated thermal unit is used to describe the cumulative effect of temperature over time. it is calculated by multiplying the average temperature (in degrees Celsius) of a period by the number of days in the period. For example, in an environment at a constant temperature of 5 °C, 5 ATU would accumulate per day, with 75 ATUs accumulated after 15 days. Using this knowledge, one is able to compare and calculate biological progression of fish (e.g. expected incubation periods) over a wide range of temperatures and time periods.

To give another specific example. If one says the withdrawal period of a drug is 360 degree days from the last day of administration to a fish, this means that if the water is a constant 18 degrees Celsius this would mean a withdrawal period of 20 days. However if the water was colder at say 10 degrees Celsius , then the withdrawal period of the same drug to the same fish would now be 36 days.

This can be very useful for farm management, as it allows for essential planning to occur over a range of process such as starvation before a procedure like vaccination or harvesting and over the whole hatchery phase.