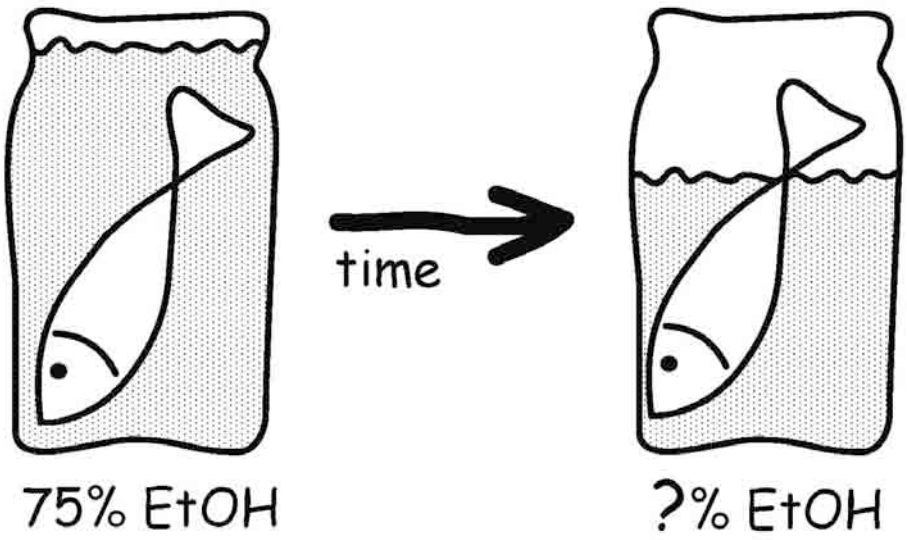
Alcmon

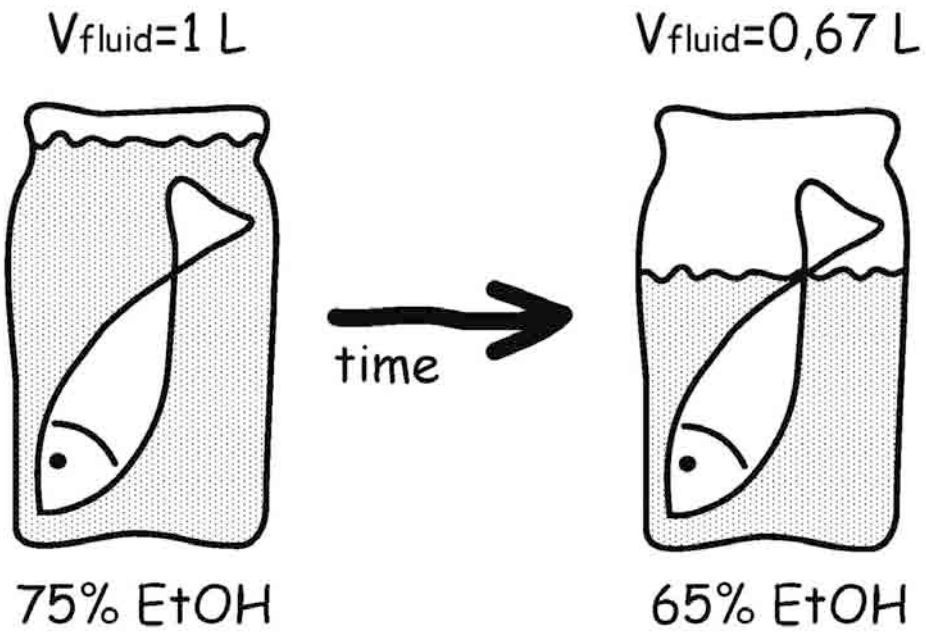
A SIMPLE INSTRUMENT TO MONITOR THE ETHANOL CONCENTRATION IN FLUID PRESERVED SPECIMENS



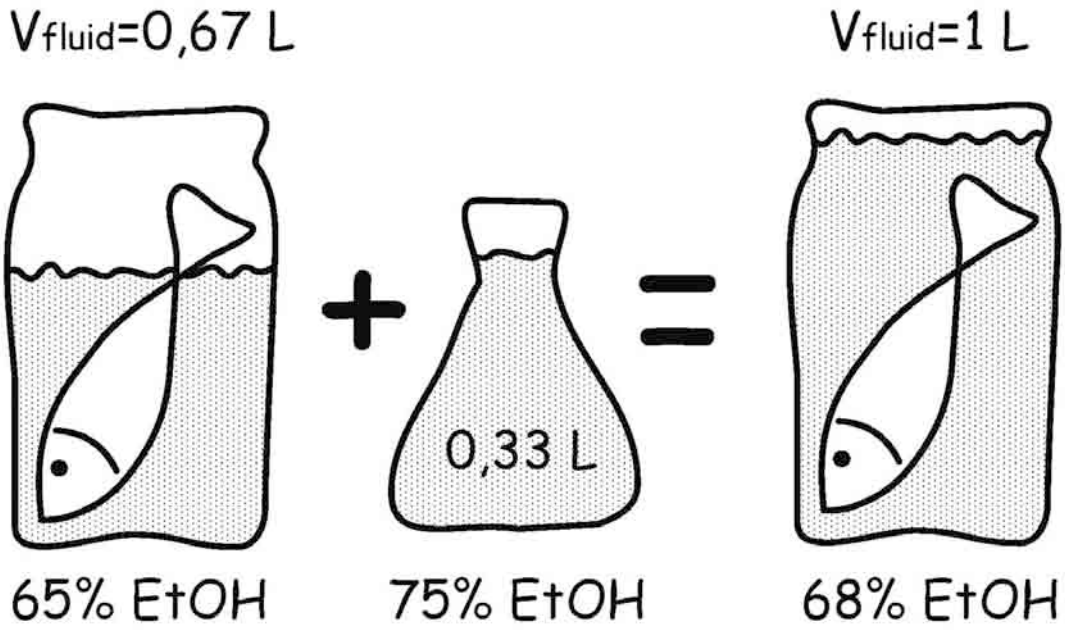
Fluid loss can be regarded as one of the major problems in spirit collections. As long as the fluid and its saturated vapor provide in sufficient antiseptic protection, fluid loss does not have to result in immediate damage to the specimens. However, especially with ethanol preserved specimens, fluid loss can have a direct impact on the preservation quality of the fluid.

In 1995 Velson Horie described in his paper titled “A short study into the changes in alcohol concentration due to evaporation” that a 50 % loss in jar contents leads to a 10 to 15% decrease in alcohol concentration.

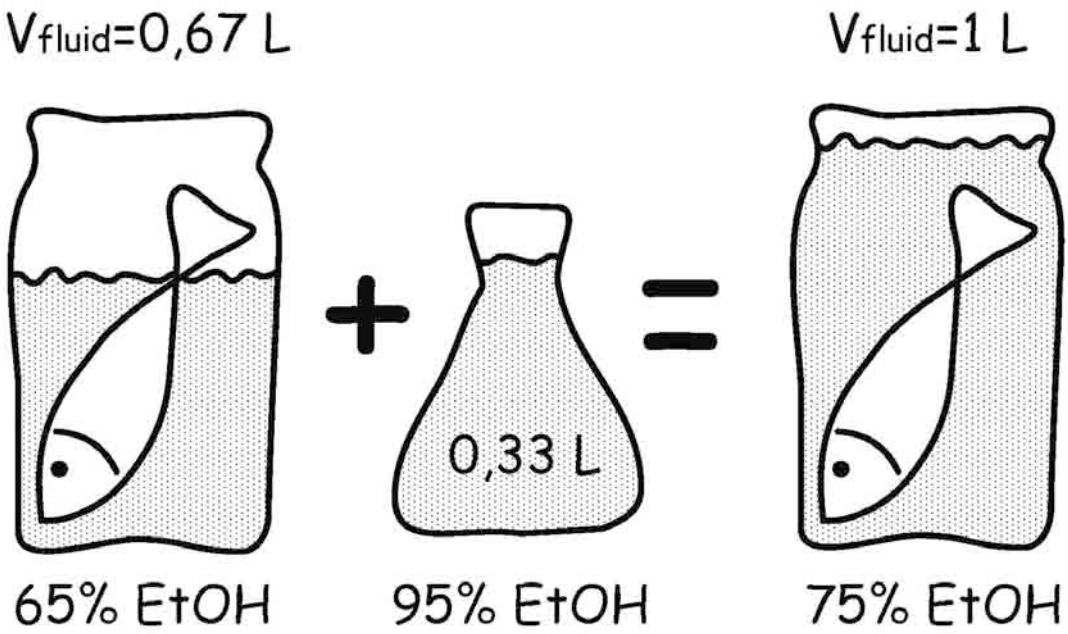
As a result, the simple act of topping a jar up will not bring the solution back to full strength but will result in a gradual decrease in the alcohol concentration in the jar. This eventually can lead to ethanol concentrations dropping below effective preservation levels.



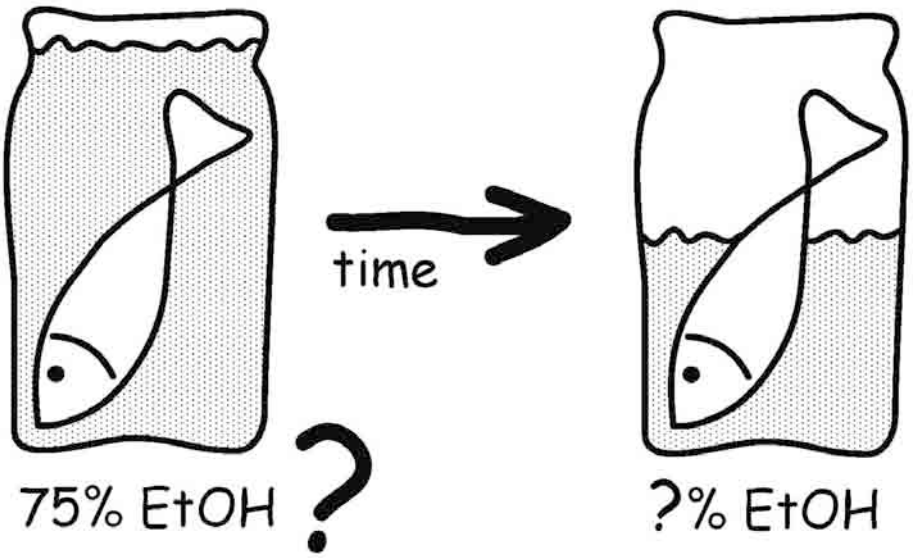
In 1996 Robert Waller and Thomas Strang described in their paper on properties of ethanol-water solutions that these solutions are most strongly antiseptic in the range of 50 to 80% ethanol. This means that dropping of the ethanol concentration below 50% must be avoided. Lets assume we have a fish preserved in 75% ethanol. At a certain moment, there is a one third loss in jar contents and a 10% decrease in the ethanol concentration.



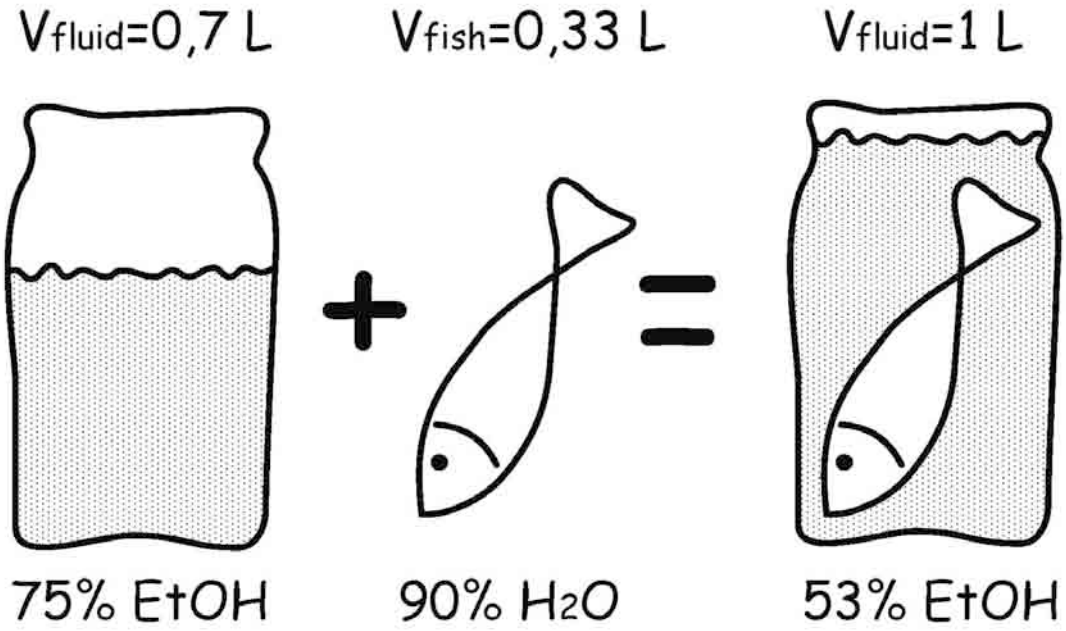
When we top the jar up with 75% ethanol the end concentration will be 68%, which is considerably lower than the original concentration of 75%. We might want to think that once the jar is topped up again the EtOH concentration is also at its original strength, which is definitely not the case. The next time that a considerable fluid loss is seen in this jar, the concentration might already be lower than 60% putting the specimen more and more at risk.



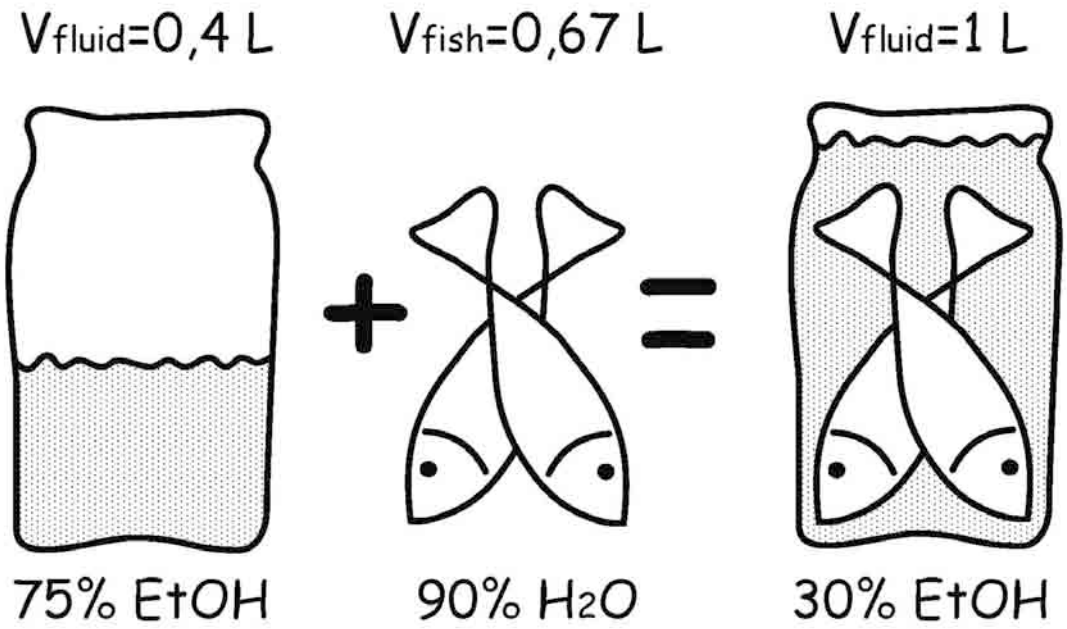
Only by filling the jar with 95% ethanol will bring the concentration back to its original strength.



In the examples shown the assumption was made that we started with the ideal situation of a specimen preserved in 75% ethanol. But when we preserve a newly collected specimen in ethanol, do we really start with a concentration of 75%?



When for example a fresh or formalin fixed fish is placed in a jar and filled with 75% ethanol, the alcohol will be diluted by the water present inside the specimen, which will immediately result in a lower ethanol concentration inside the jar.



Especially, when the volume of the specimen is relatively large compared to the jar volume, a significant drop in the ethanol concentration can be expected. Subsequently, a relatively small amount of fluid loss can easily result in ethanol concentrations below 50%.

Decrease of ethanol concentration due to fluid loss in specimen jar depends on:

- EtOH concentration
- vapour pressure EtOH/H_2O
- EtOH/H_2O permeability of jar, lid, and seal
- Temperature
- Relative Humidity outside

The decrease of the ethanol concentration depends on a variety of factors, which makes it very complex to predict what the concentration will be after a certain amount of fluid loss. In fact, we can only determine afterwards what the concentration drop has been by performing density measurements before and after the fluid loss occurred.
Besides storage temperature and humidity, the type of jar, and how tight the lid has been put on top of the jar have a direct influence on fluid loss and concentration drop. Therefore, the fluid of each jar has to be individually weighed to determine if the concentration still meets with the minimal required antiseptic properties.

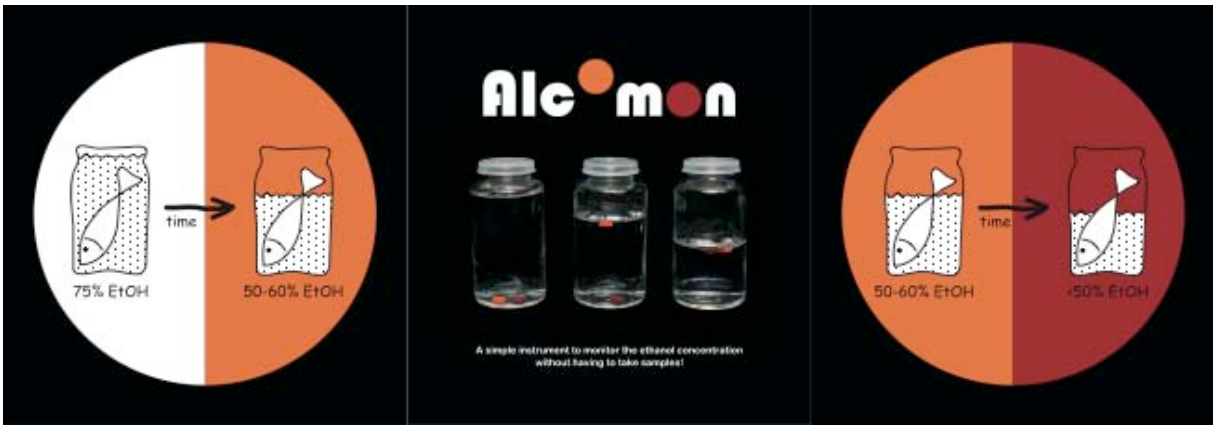
These density measurements can be performed in two ways:

1. Weighing a fluid sample by means of a specific gravity hydrometer, which is scaled and calibrated to give readings of the ethanol concentration between 0 and 100%.

The minimal sample volume is about 25 to 50 ml depending on the maximal diameter and height of the hydrometer.

2. Weighing a fluid sample by means of a digital density meter, which calculates the density from the measured resonance frequency of the oscillated fluid. The minimal sample volume is 1 ml.

Both methods require a fluid sample to be taken out of the jar, whereby each jar has to be opened in order to extract the sample. Consequently, these assessments are very time-consuming although necessary to guarantee a high preservation quality throughout the collection.



For these reasons, the so-called Alcomon Indicator System has been developed; an instrument that monitors the ethanol concentration in fluid preserved specimens and therefore eliminates the need to perform time-consuming conventional density measurements.

When the indicator is added to the fluid in a specimen jar, it continuously shows if the ethanol concentration is above or below a specified level that for instance relates to the minimal required antiseptic properties of the preservative.

In the case of the red colored prototype, the indicator body floats when the ethanol concentration is below 50% and sinks when the concentration is above 50%. The indicator reacts in this manner because its density is the same as that of 50% ethanol. In practice, this means that when the indicator floats it will warn us that the ethanol concentration is below 50% and action has to be taken to bring the concentration above 50%, or preferably bring the concentration back to about 75%.

However, since we do not know the exact ethanol concentration when the indicator floats, it is possible that the concentration is that low that damage to the specimen has already occurred. For these reasons, a second orange indicator has been developed which has the same density as 60% ethanol.

Starting with a freshly filled jar with 70 % ethanol both indicators will be on the bottom of the jar. After a certain time we discover that in several jars one indicator floats. This tells us that in these jars the ethanol concentration has dropped to a concentration between 50 and 60%. We know that the preservation strength of the fluid is still sufficient, which means that there is no immediate threat to the specimen.

Now, we can plan at a convenient time a topping up procedure to increase the ethanol concentration of those jars where this situation has occurred. Also, we can calculate the ethanol concentration that has to be used for topping up the jars in order to get the fluid back to its original strength. There is no the need to perform additional density measurements. The topping up procedure can be carried out in the most efficient way.

In conclusion, the Alcomon Indicator System can give a major contribution to a constant and high preservation quality of ethanol preserved specimens. In addition, its integration in your collection care program considerably simplifies the maintenance routine and cuts back maintenance costs.

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CONCENTRATION IN FLUID PRESERVED SPECIMENS

The Alcomon Indicator System consists of two small indicator pellets:

Alcomon 5 (red) ⇔ shifting-point: 50 ±2 % v/v ethanol in water at 20 °C

Alcomon 6 (orange) ⇔ shifting-point: 60 ±2 % v/v ethanol in water at 20 °C

The Alcomon Indicator System is exclusively distributed by:

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