Counting

Zooplankton counts are carried out using **a dissecting microscope and a Bogorov Tray** (Figure 6). Unlike phytoplankton, the entire sample is counted.

- The sample is poured onto a sieve with a mesh size 200-µm or less (Figure 7).
- The zooplankton are collected by washing them gently with filtered seawater into the Bogorov tray.
- The tray is placed under a dissecting microscope and the zooplankton are counted by sorting through them using a probe or a seeker.
- The process may need to be repeated if there is a large quantity of zooplankton in the sample.
- The zooplankton count will tell you exactly what was in the volume sampled.

Example: You count 300 *Obelia* species in your sample. The zooplankton net was 40 cm in diameter, so the volume sampled was: $\pi r^2 \times h = 3.14 \times 0.2\ m \times 0.2\ m \times 10\ m = 1.256\ m^3$. Therefore *Obelia* per m^3 would be 300 divided by 1.256 = 239 *Obelia* / m^3.

Figure 7. Sieve with 200-µm mesh used to filter sample and enable collection of zooplankton.

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Plankton sampling

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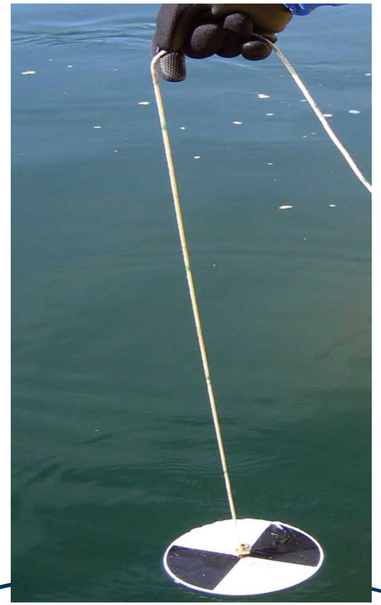
Plankton sampling

Plankton sampling is an important management tool for all fish farms. In cases where plankton levels are too high, we can take action to protect the fish, such as stop feeding or provide oxygen. There are two types of plankton – phytoplankton (plant component of the planktonic community e.g. microalgae) and zooplankton (animal component of the planktonic community e.g. jellyfish).

Phytoplankton sampling

A **secchi disk** measures turbidity in the water (Figure 1). The disk is lowered, and the depth at which the pattern on the disk disappears is the secchi disk reading. If the depth is less then 4 m, it may indicate there is a bloom present.

An **Oxygen probe** measurement should be taken twice daily inside pens. Higher than normal oxygen can indicate there is a bloom present. Low oxygen can indicate there is a bloom present that is dying off.



There are three main tools used for sampling phytoplankton from the water: a **Phytoplankton vertical trawl net** (Figure 2), a **Lund tube**, and a **Van Dorn sampler** (Figure 3). Whatever method is used, if the sample cannot be examined immediately, a few drops of Lugols iodine can be added for preservation.

1. **Phytoplankton vertical trawl net:** this is the best most accurate option as it filters a greater volume of water. The mesh size is very small so can capture all important species (typically 20 – 50 µm) . **BUT** remember that the sample will be concentrated, and a dilution factor needs to be applied after counting.

Method

The net is lowered to a depth of 10 m and then pulled slowly upwards. The net is dipped slowly up and down near the water surface to wash any plankton down the insides of the net. The filter net end is unscrewed (inset, Figure 2), inverted, and the plankton are washed into the sample bottle using 50 ml of seawater.

2. **The Van Dorn sampler:** this is useful to get a picture of concentration of plankton at a certain depth in the water – frequently 5 m or 10 m depth.

Method

The Van Dorn is opened and set. Once it is in the correct position it is lowered to the desired depth. The Van Dorn is then pulled sharply upwards which closes the sampling container allowing a snapshot of the water column to be taken at the specific depth. The tap is opened, and a sample is decanted for analysis.

3. **The Lund tube:** this is the most basic method used for sampling. They are easy to make and use but they give the least accurate result. Lund tubes only sample a small volume spread over a large depth.

Method

The Lund tube is lowered weighted end first into the water until desired depth is reached. The stopper is then placed in the top of the tube, and the tube is removed from the water. The contents of the tube are released into a bucket. The bucket is swirled and a 30 ml sample is removed for analysis.

Figure 2. Phytoplankton net with sampling bottle and (inset) filter removed from base of net.

Figure 3. A Van Dorn sampler being lowered into the water.

Counting

Phytoplankton counts are carried out using a **light microscope** and a **Sedgewick Rafter slide** (Figure 4).

- Swirl the water sample then sub-sample at least 1 ml using a micropipette.
- Pipette 1 ml sub-sample into the well of the Sedgewick Rafter Cell.
- Slide across the coverslip. This captured volume will be exactly 1 ml.
- Re-sample if air bubbles present.
- Allow to settle, then count the plankton (both total number and by species) by examining the slide under the microscope.

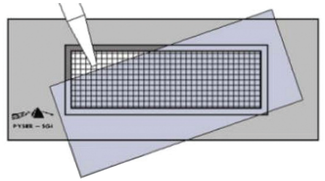


Figure 4. Pipetting sample into Sedgewick rafter slide. The rafter slide is 20 X 50 squares.

A Sedgewick rafter contains 1 ml volume and is marked as a grid, containing 20 x 50 x 1 mm squares. The accuracy of the count depends on how many squares you count. Aim to count at least 100 squares, repeat, and take the average of the two counts. Then scale up your count to the full volume of the slide, for example if you counted 100 squares, then X 10 to get total in the 1ml volume.

At low density (<1 cell in 10 squares) then simply record the plankton as 'present'- unless it is *Chaetocerous* species or other algae known to be harmful at low density.

IMPORTANT: DO NOT RELY ON A ZOOPLANKTON NET TO SAMPLE PHYTOPLANKTON – ALL SPECIES SMALLER THEN 200-µm WILL PASS THROUGH THE NET!

Calculations

Remember where your sample came from. You may have to adjust your count for dilution factor!

Van Dorn or Lund tube: Number of plankton in the rafter 1 ml X 1000 = cells / Liter in the seawater.

Phytoplankton trawl net: 10 m vertical trawl basically creates a cylinder sample 10 m high.

The volume sampled by the net can therefore be calculated like a cylinder, that is $\pi r^2 \times h$ (r = radius, h = height).

Example: Diameter of the phytoplankton net is 40 cm (radius is 20 cm or 0.2 m).

Volume is 3.14 X 0.2 m X 0.2 m X 10 m = 1.256 m^3 or 1256 Litres.

50ml of seawater is used to wash the plankton off the filter into the sample bottle.

1ml of this is transferred to rafter slide for counting.

Say the count is 50,000 phytoplankton cells in the 1ml of concentrated sample in the rafter slide. To convert this to cells per litre in the actual seawater you do as follows:

50,000 Phytoplankton cells X 50 ml / 1256 Litres = 1,990 cells per Litre.

Zooplankton sampling

A Zooplankton 200-µm mesh ring net (Figure 5) is used to perform a vertical trawl to sample zooplankton. This is similar to a phytoplankton net but has a larger diameter and the mesh size is much bigger. The net should have a weight attached to the the bottom to ensure it remains vertical during sampling.

Method:

The sample bottle is attached to the cod end of the net. The net is lowered to a depth of 10 m and then pulled slowly upwards.

The sample bottle (inset, figure 5) is inverted and pressed against the side of the net to allow some of the water out and to concentrate the sample.

The net is then washed down on the outside with seawater several times to flush any remaining zooplankton adhering to the inside of net into the sample bottle.

The bottle is unscrewed, and the sample is poured into a collection bottle. If the sample cannot be examined immediately, it should be preserved in 4% seawater formalin (equivalent to 1 part 37.9% formaldehyde solution, 9 parts filtered seawater).

Figure 5. Zooplankton net being lowered into the water to collect sample. Inset top left: cod end of net with sampling bottle attached.

Figure 6. Bogorov tray used for counting zooplankton samples.