

## A Class Project on Succession (Students Worksheet)

Ecological succession is the process of change in the community species composition and structure over time. In this project, you will observe succession on new discs which have not been originally inhabited by organisms. This is called **primary succession**. In contrast, **secondary succession** is observed in communities which have been subjected to a disturbance like a forest wild fire or complete deforestation. With the discs this can be likened to using a cleaned disc (disturbance) which has been previously used for another experiment.

Formulate your questions and your hypothesis:

### 1. What you need:

#### Materials

- The discs and racks to be used should be new. These can be made of plastic or wood but be sure to be consistent to use the same material for the entire investigation.
- The racks\* usually used for the VIRTUE-s projects can be seen in Fig.1. A weight is placed at the end of the rack so the construction will stay underwater. Details of rack construction are provided in:

[http://science.gu.se/digitalAssets/1533/1533296\\_assembly\\_instructions-virtue-rack.-version-2015.pdf](http://science.gu.se/digitalAssets/1533/1533296_assembly_instructions-virtue-rack.-version-2015.pdf)

- Cameras; Microscope cameras
- Stereomicroscopes or magnifying lenses
- Buckets and deep dishes

#### Optional materials

- Thermometer
- Echo sounder
- Secchi disc
- Refractometer for measuring salinity
- Light meter
- Kitchen scale

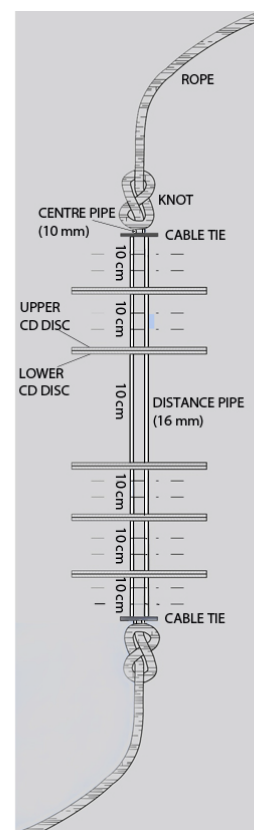


Fig. 1. A VIRTUE-s rack

\*Alternative rack construction (Kiel Model)

Petri dishes with holes in the middle can be used as discs. These are connected to each other by using stainless steel carabiner snap hooks attached to ropes (Fig. 2). The advantage of this configuration is that you can add successive discs to an existing line without disturbing the older discs. You can also vary the position of the discs along the line to eliminate the influence of depth. It should be noted that stainless steel snap hooks should be used because these do not rust and corrode in seawater. You might lose your discs if the hooks rust and do not snap close properly. Attach a weight to the last disc to submerge the entire construction.

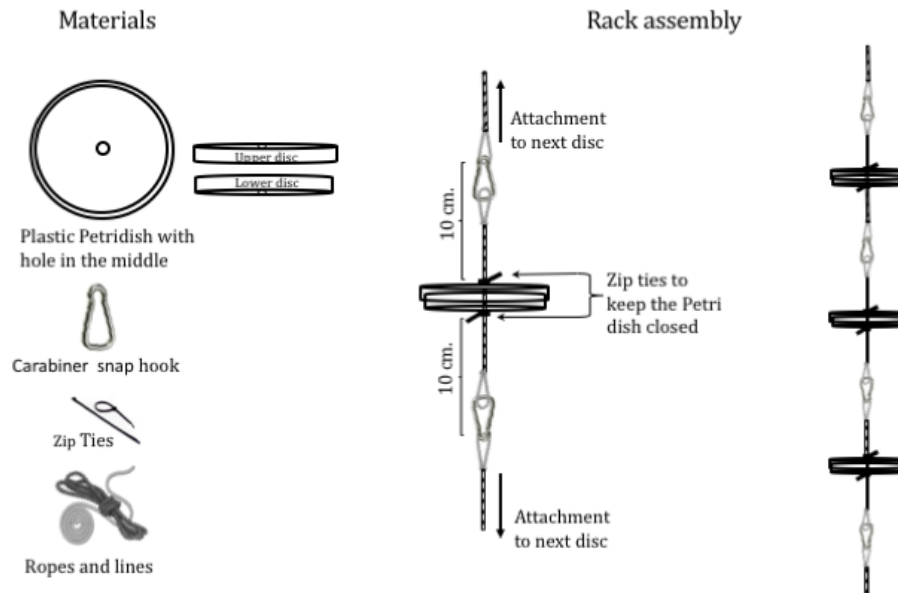


Fig. 2. Alternative rack construction using plastic petri dishes

**2. How do I do the experiments**

Create your experimental design. Fill up the table below to help guide you in planning your experiment. On the rightmost column is an example of a project about succession.

After finishing the table make a more detailed plan of how you are going to do your experiments. A well-planned experiment will save you a lot of time and frustration at the end. List down all the materials you need as well as what data you want to collect.

For collecting and recording your data you can use the protocol sheet provided with this worksheet. You can also design your own.

## My Experimental Design

<b>Collecting Data:</b>	<b>Your answer</b>	<b>Example</b>
What question would you like answered?		What is the chronological progress of colonisation of a disc in the sea?
What are you changing?		The time and duration of deployment.
What are you measuring?  (Dependent variables)		<ul style="list-style-type: none"> <li>- The growth of fouling organisms on the disc.</li> <li>- The number of species on the disc.</li> <li>- The number of individuals for each species on the disc.</li> <li>- The amount of the disc covered with organisms.</li> </ul>
What factors may affect your results but which you are not changing?  (Independent variables)		Temperature Salinity Turbidity Light Time of the year
What are you keeping the same throughout the experiment?		Rack design and material Number of replicates/discs per deployment Place of deployment Depth of deployment Intervals between deployments
How will you record your results?		Protocol sheet for succession (provided).

# Protocol sheet:

Name:

Location:

Date of deployment:	Date of retrieval::	Number of days in the water:	Depth (Meter)	Salinity (‰)	Temperature (°C)
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Disc number	Total Number of Individuals*																Comments
	Wet weight (g)	Estimated total percentage cover (%)	Filamentous Algae (%)	Leaflike Algae (%)	Barnacles	Polyps	Mussels	Tubeworms	Tunicates	Bryozoans	Snails						
Upper disc																	
Lower disc																	
Upper disc																	
Lower disc																	
Upper disc																	
Lower disc																	

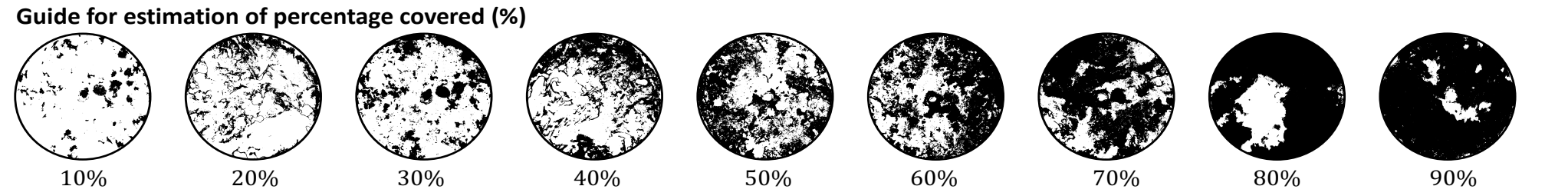
**\*Calculation of the total number of organisms on the disc (Z<sub>G</sub>):**

$$Z_G = \frac{N_a \times O_G}{O_a}$$

N<sub>a</sub> = Total number of organisms in all counted quadrats  
 O<sub>a</sub> = Total area of all counted quadrats  
 O<sub>G</sub> = Total area of the entire disc

Total number of species found:

Total number of all organisms found:



### 3. How do I analyse my discs?

Here is a suggested workplan upon retrieving your discs:

- a. **Determine the wet weight of the upper and the lower disc separately.** Let the discs drip as much water as possible before weighing on a kitchen scale.
- b. Place the discs in a deep dish with seawater. The discs should be immersed in seawater.
- c. **Examine the discs visually** to get an overall picture of the disc. **Estimate visually the percentage of the disc covered with fouling organisms.** Use the guide for visual estimation of percentage cover on the protocol sheet.
- d. **Try to identify as many organisms as you can** without using a stereo microscope or a microscope. Use magnifying lenses.
- e. **Take photos of the entire discs** for percentage cover estimation.
- f. **Place the dish with the disc under the stereomicroscope.**
- g. **Place a grid on top of the disc.** (See suggested grid material "Make life easier" on BASECAMP).
- h. Examine the discs first under the lowest magnification and try to identify the major species you can find.
- i. Use a magnification where you can see an entire quadrat on the grid and you can recognise the organisms clearly.
- j. **Count the individuals for each species in a quadrat. Count as many quadrats as you can.**
- k. **Enter your observations on the protocol sheet.**

### 4. How do I visualise/present my data?

- a. Enter your data on an Excel sheet. (Enter your data on Virtuedate Website). Combine all the data for all the discs.
- b. Create a graph showing how the measured physico-chemical parameters varied with time during the duration of your experiments. You can use Excel or you can draw it by hand.
- c. Create a column graph showing how the biomass changed in the upper and in the lower discs with time. You can use Excel or you can draw it by hand.
- d. Create a column graph showing how the percentage cover changed in the upper and in the lower discs with time. You can use Excel or you can draw it by hand.
- e. Create a column graph showing how the percentage cover or the number of individuals of each species changed in the upper and in the lower discs with time. You can use Excel or you can draw it by hand.
- f. Determine species richness as a function of time. (Species richness is just the number species present on the discs).
- g. Calculate the Simpsons Index of Diversity for the oldest upper and the lower discs using the following formula:

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

Where

D= Simpsons Diversity Index

n= Number of individuals for each species



