# Simple subtidal rocky reef environmental parameter station

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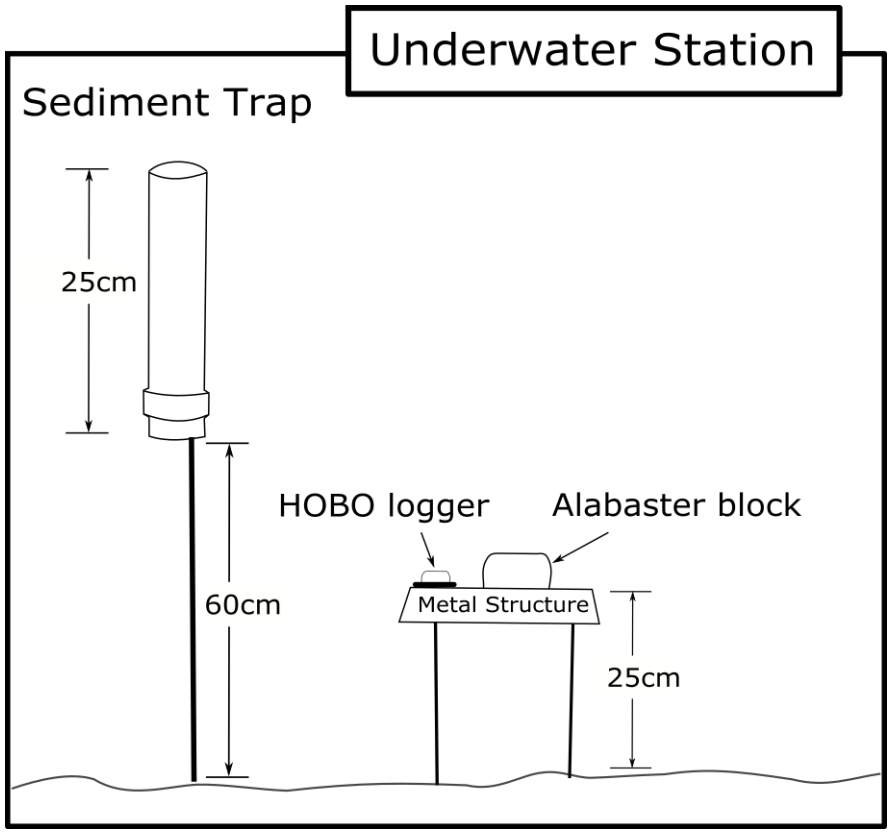
ABSTRACT

This is a simple system that can be deployed on rocky reefs to measure environmental variables such as sea temperature, light intensity, sedimentation rates and water flow during short periods of times (5 to 60 days). This station can be constructed with different materials, here we present the system used on rocky reefs from Patagonia Argentina.




Variables measured:

- Water temperature and light intensity were registered by HOBO® Pendant® Temp/Light (MX2202) Loggers. The logger measures light intensity in units of lumens/ft2 or lux and has a range of 0 to 167,731 lux (15,582 lum/ft2). The temperature sensor accuracy is ± 0.5°C from -20° to 70°C with a resolution 0.04°C. See HOBO manual for more specifications. Light and temperature was recorded once every 10 min.

- PVC tube traps (open-ended containers) were used to collect and retain sediment that settles from the water column to acquire information of the sedimentation rates on different rocky reefs. The PVC tubes of 50 mm mouth diameter and 200 mm height had an aspect ratio > 3 as recommended by Hakanson et al. (1989) to avoid losing the trapped sediment because of water flux.

- Dissolution rates of alabaster blocks (plaster of Paris) was used to investigate differences in water motion. This low-cost method has been used in several studies for measuring water motion in subtidal habitats (e.g. Watson, 1976; Leichter and Witman, 1997; Irving and Connell, 2002; Connell, 2005). All measures were made simultaneously at all rocky reefs while one alabaster block was deployed inside a 20 L recipient to serve as



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control as recommended byJokiel and Morrissey (1993).

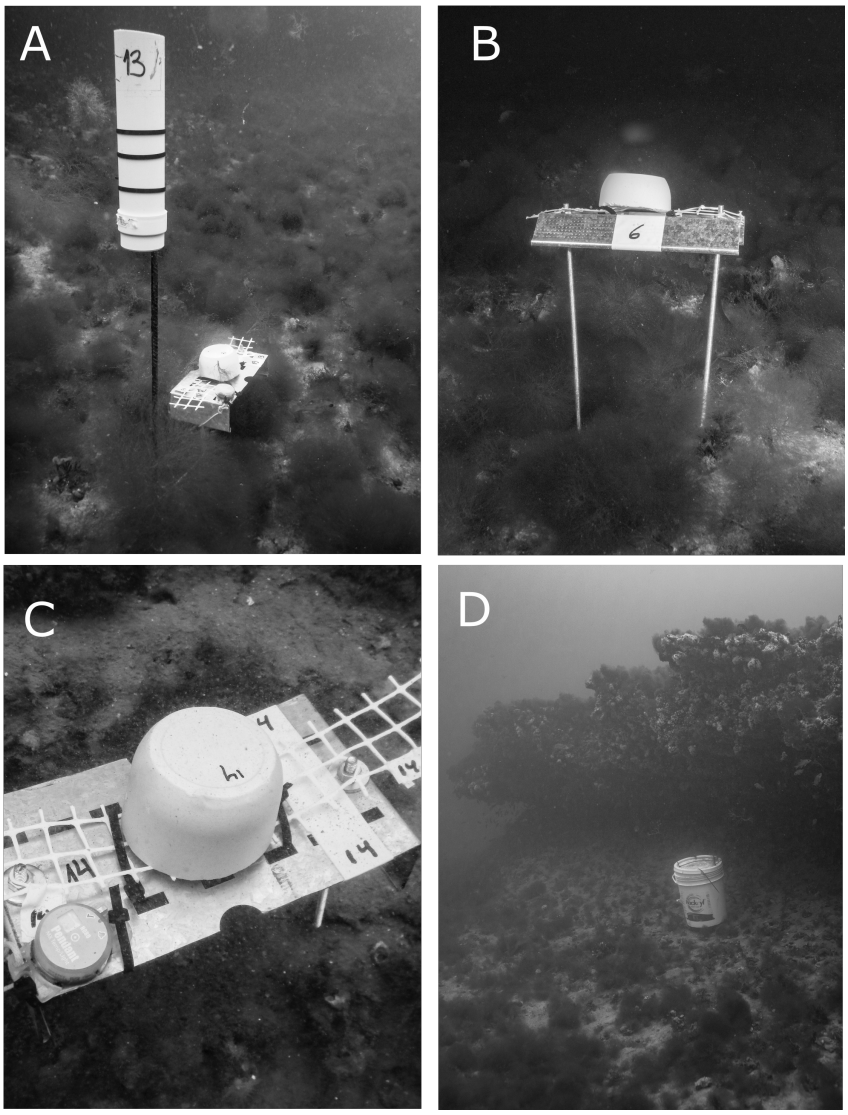


Figure 1 (A) Station deployed on a rocky reef, (B) metal structure with alabaster block, (C) upper view of the alabaster block and the HOBO logger and (D) 20-liter container with the control alabaster block inside.

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KEYWORDS

sediment trap, rocky reef, environmental variables, sedimentation , low-cost

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MATERIALS TEXT

- HOBO® Pendant® Temp/Light (MX2202) Loggers
- PVC tube (Ø 5 cm)
- Iron bars (Ø 8 mm)
- Metal or plastic flat structure (20 cm)
- Galvanized threaded rods (Ø 8 mm)
- Plaster of Paris
- Plastic mold for alabaster blocks
- Plastic zip ties
- Plastic mesh

SAFETY WARNINGS

The divers that will performe the deployment and recovery must be able to work with tools as hammer underwater.

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## PREPARATION OF SEDIMENT TRAPS

1 PVC tubes of 50 mm diameter were cut into 200 mm long pieces.



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One of the extremes of the tube was covered by fixing a PVC cup in order to perfectly close that end.

Each trap was identified with ID number (Figure 1A). n=3 traps in each reef .

130 cm Iron bars (8 mm diameter) were prepared to hold each PVC tube by plastic seals.

A plastic mesh (Mesh Opening 24 mm) was installed at the mouth of the PVC tube to avoid large fauna getting inside.

## PREPARATION OF ALABASTER BLOCKS

2 We didn't use the classic clod cards made with ice cube trays (Doty 1971) because their size allows deployments of one- or two-day max. Instead, semi-spherical blocks (7 cm diameter) were made using plastic containers as molds (e.g. cream containers). This size of block can last several (5-6) days in areas with moderate currents (Figure 1B).

The plaster of Paris was prepared with a 3:1 water proportion and dried at 30 C until they arrive to a constant weight.

A plastic mesh was added inside the block before drying and afterwards was used for attaching the blocks to a metal structure and for labeling each block (Figure 1C).

## PREPARATION OF BASE METAL STRUCTURE

3 In order to have a flat structure separated 30 cm from the seafloor to install the alabaster blocks and loggers, we used an aluminum structure from which two threaded rods (8 mm) of 40 cm long were used to pin the structure to the sea floor (Figure 1B).

As deployments were short, we didn't use stainless steel, which increased the price considerably

## DEPLOYMENT OF STATIONS

4 Iron bars (130 cm) were hammered into the rocky reef. PVC sediment traps were fixed to the iron bars with cable ties so that they were aproximately 100 cm from the seafloor (Figure 1A). Another option could be the replacement of plastic zips for another material as metal clamps or ropes, which will make more expensive and difficult to deploy.

Two iron bars (30 cm) were hammered into the seafloor and the flat metal structure was fixed to them through bolts. Once the metal structure was secure, the alabaster block and logger were fixed to it in situ (Figure 1 B, C).

A 20-liter container with an alabaster block inside was installed in one of the stations in order to have a calm water control at the same temperature and salinity where the alabaster blocks were deployed (Figure 1D). The volume of the water containing the control block was enough to avoid saturation of the water in the container as recommended by Jokiel & Morrissey (1993). The container was fixed to the seafloor using a 8 mm iron bar.

## TIME OF DEPLOYMENT

5 Sediments traps were left underwater for 63 days.

Alabaster blocks and loggers were deployed for 6 days.

## RECOVERY

6 For sediment trap recovery, a diver closed the PVC tube with a custom plastic cap in order to retain the sediment inside while emerging. Plastic zip ties were cut off to separate the PVC tube from the iron bar. If no more traps will be installed, iron bars should be removed from seafloor.

The flat metal structure with the loggers and alabaster block was removed as a unit using
the claw part of the hammer to unlock the galvanized threaded rods that were fixed to the seafloor.

**Note:** caution must be taken to avoid damage with hammers to alabaster blocks and loggers during recovery.

## LABORATORY PROCESS

7 PVC tubes with sediment and sea water were transported into the laboratory. Cups were removed and the water with the sediments was sieved with a 60 µm and 39 µm mesh.



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For this study > 60 µm = coarse sediment and <60 µm >39 µm = fine sediment. All the sediment contained in the mesh was dried at 60°C until constant weight. Fractions were weighed separately.

The alabaster blocks were dried at 60 °C until constant weight.

## SEDIMENT RATES CALCULATIONS

8 In order to get the total sedimentation rates in $g.m^{-2}.d^{-1}$ , the weight of both fractions in (g) was divided by the deployment days and the area of the sediment trap mouth ( 0.00785 $m^2$)
See example:

| Tramp number | Site | Weight >39 µm (g) | Weight >60 µm (g) | Total sediment weight(g) | Deployment day | Recovery day | Days in water | Trap mouth area m2 | g.m-2 . d-1 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Colombo | 1.83 | 0.33 | 2.16 | 2019-03-22 | 2019-05-24 | 63 | 0.00785 | 4.38 |

## DIFFUSION FACTO CALCULATIONS

9 Diffusion factor (DF) was originally defined by Doty 1971 and calculated as:

(Final weight – Initial weight)/ (Final weight control – Initial weight control)

DF was used because it can be used for comparisons involving different alabaster blocks in other sites.



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