

Review of approaches to study bacterial activity and diversity along the organic matter continuum

Mireia Mestre, Encarna Borrull, Montse Sala, Josep Gasol
Institut de Ciències del Mar (ICM-CSIC), Pg Marítim de la Barceloneta 37-49, 08003 Barcelona (Spain).

INTRODUCTION

BACKGROUND

Marine microorganisms are often classified into having 2 lifestyles, depending on their relation with the particles present in the environment:

Free-living (FL) or **Attached (ATT)** lifestyles.

Differentiation between both types is generally done by filtration, although :

- There is no consensus about the pore-size filter that should be used
- Organic matter in the oceans is present in a continuum form

Therefore, a **serial filtration** would offer a better description of the microbes attached to different fractions of the particulate matter.

OBJECTIVES

- To examine the filters and protocols that have been used in the literature to describe activity and diversity of attached microbes in the ocean.
- Provide the knowledge basis to define the best protocol to be applied.
- Characterize the structure of the particles and their associated prokaryotes as it changes due to oceanographic and biological variability.

OUTCOME

PROCEDURE

A **bibliographic meta-analysis** was performed compiling data on the pore-size of the filters used to separate FL and ATT lifestyles.

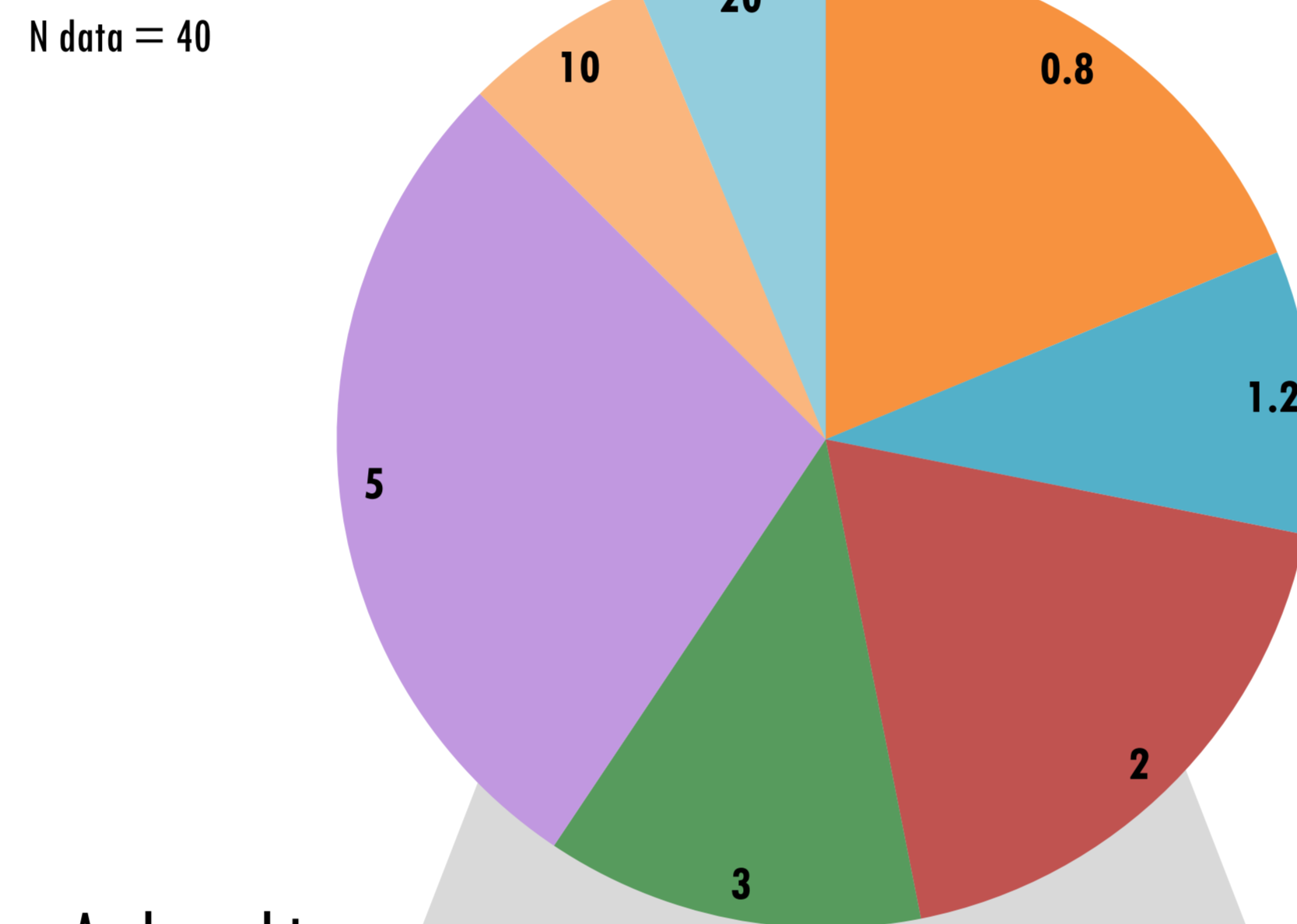
Here we included a total of 51 papers which provided 94 data sets.

The data were classified into different variables (e.g. **abundance, diversity, activity**) and into the size-intervals of particulate matter analyzed.

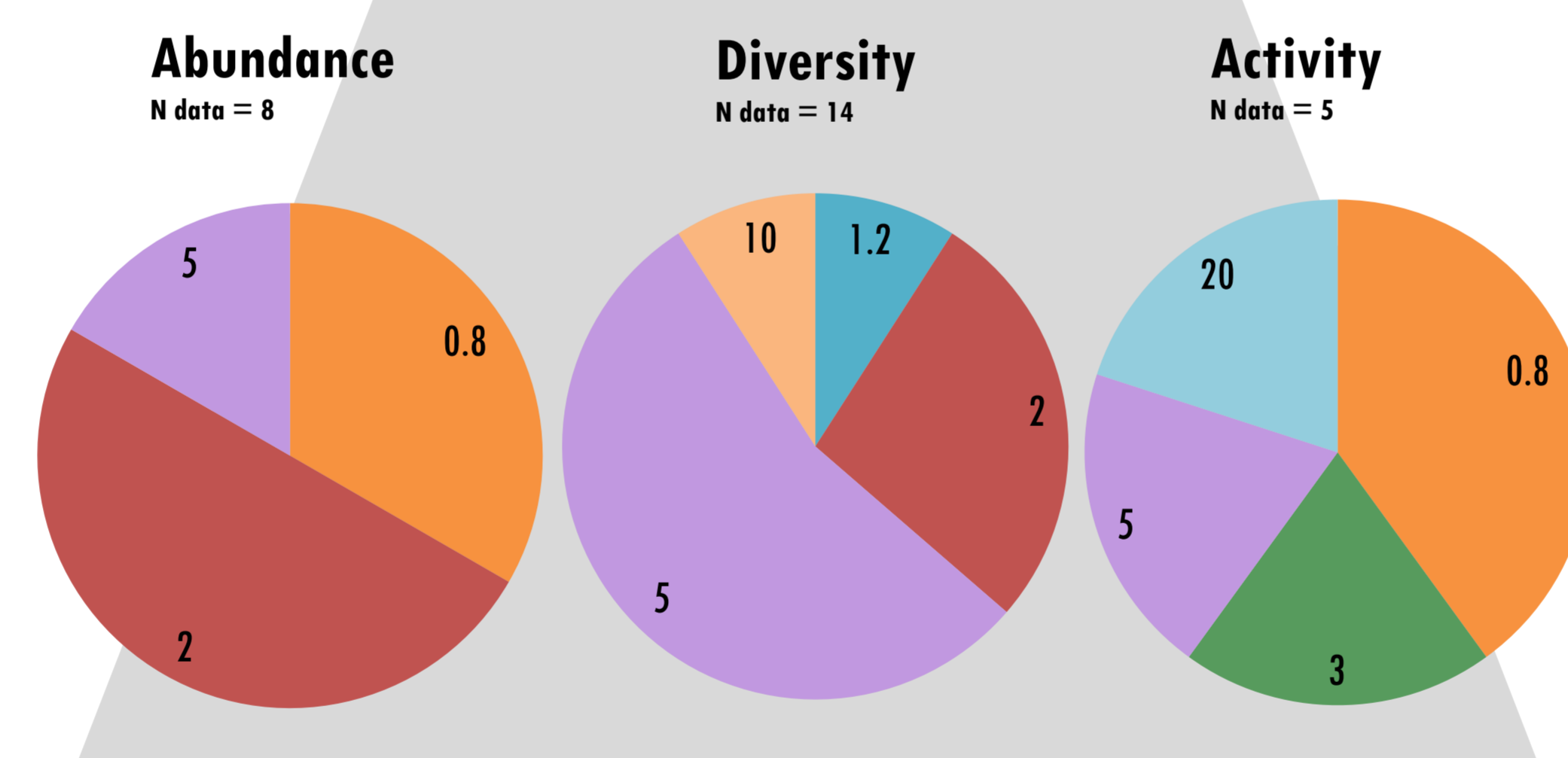
OUR META-ANALYSIS STRATEGY

#	Search (Scopus)	Objective	N papers
1	TITLE (free-living) ALL (bacteria) ALL (marine)	Articles which refer mainly to free-living marine bacteria.	187
<p>Total Papers = 187 → Papers selected = 70 → Papers processed = 51 → Total 94 Datasets</p>			
Next steps			
2	TITLE (attached AND NOT free-living) ALL (bacteria) ALL (marine)	Articles which refer mainly to Attached bacteria, but excluding the previous search.	95
3	TITLE (marine snow OR aggregate OR particle OR particulate OR adherent bacteria OR associated AND NOT free-living AND NOT attached) ALL (bacteria) ALL (marine)	Articles which refer to Attached bacteria, but with different nomenclature.	24

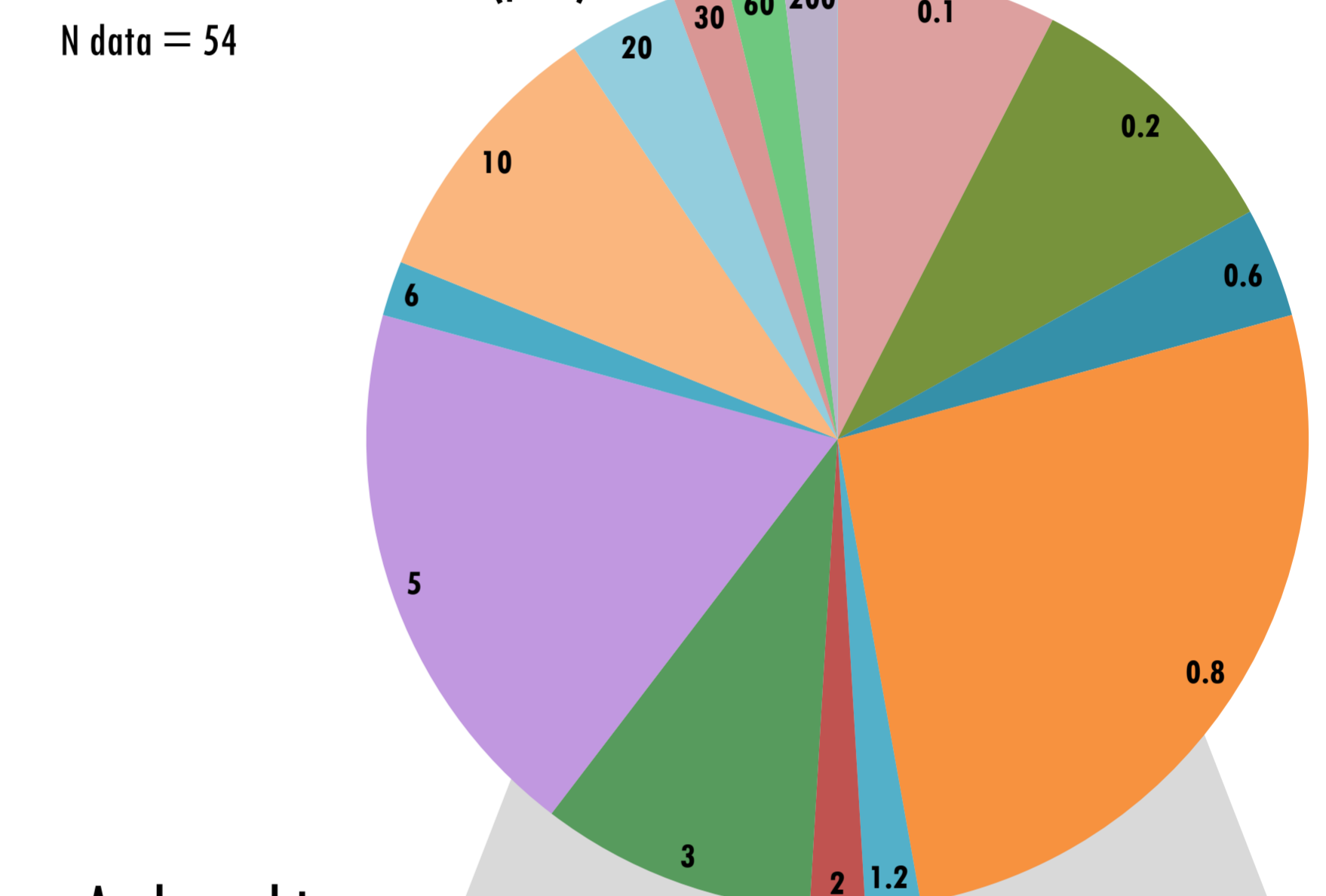
Pore-size filters used to separate **Free-living Bacteria** (μm)
N data = 40



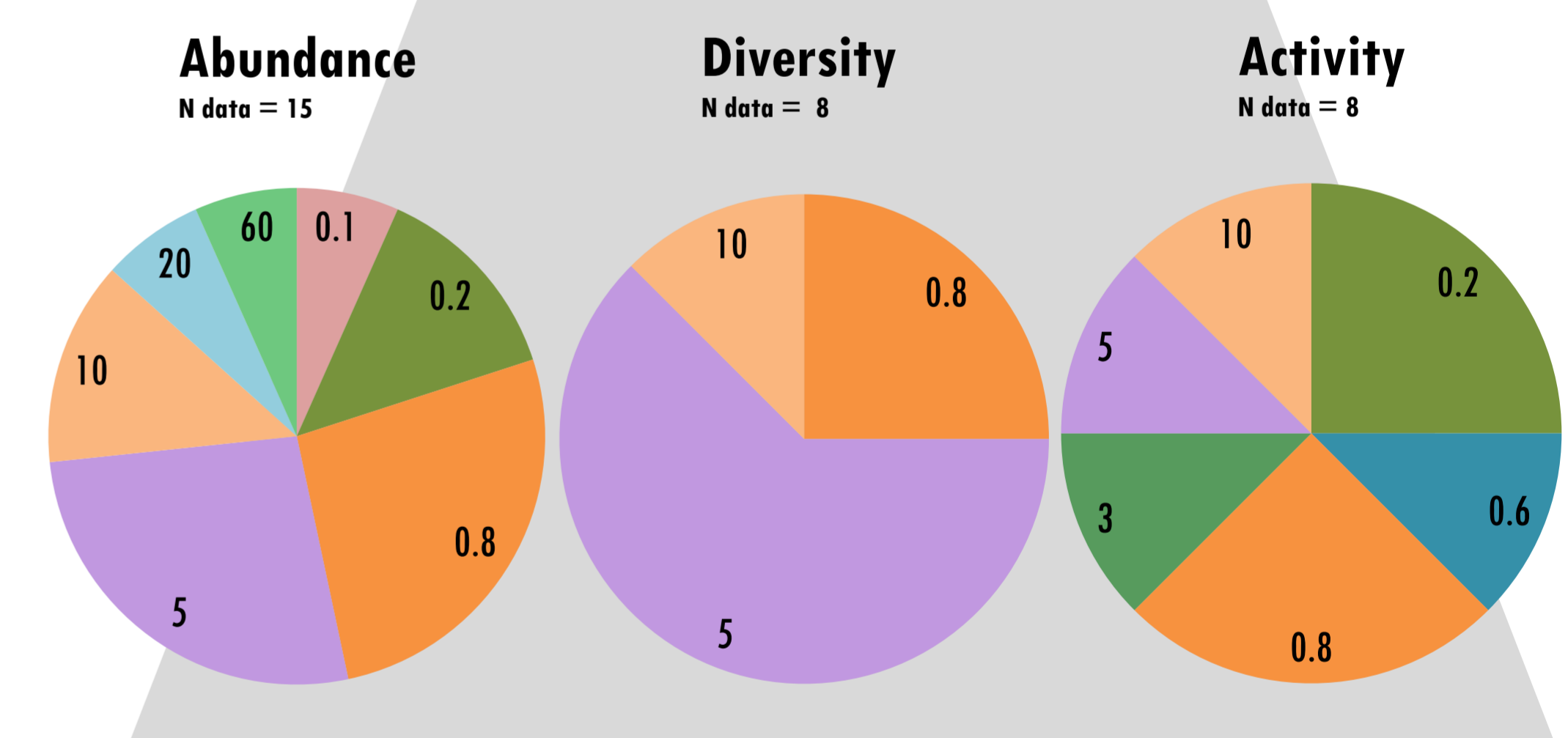
And used to measure:



Pore-size filters used to separate **Attached Bacteria** (μm)
N data = 54



And used to measure:

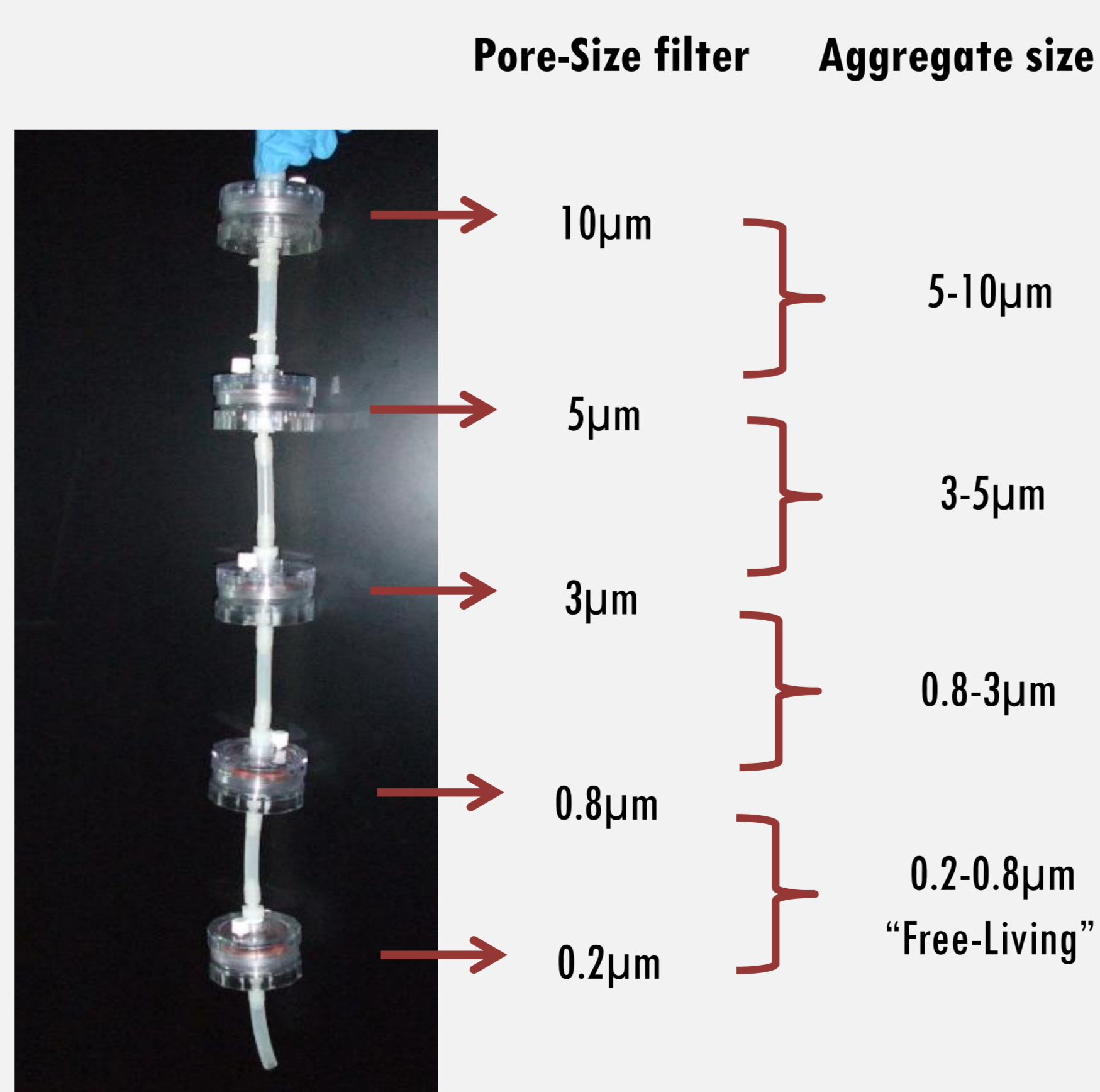


- Our meta-analysis results indicate that the most common filters used to separate FL and different aggregates are: 0.2; 0.8; 3.0; 5.0; 10.0 μm . The most common one being the 0.8 and 5 μm .
- This defines the intervals (or aggregate sizes): 0.2-0.8; 0.8-3.0; 3.0-5.0; 5.0-10; >10 μm .

FUTURE RESEARCH PLAN

NEW EXPERIMENTAL APPROACH

- Our proposal is to perform a **size fractionation sampling** placing the filters in the holders in chain.
- Based on the meta-analysis, we are using the **filters 0.2; 0.8; 3.0; 5.0; 10.0 and 20.0 μm** .
- This filtration can provide us samples mainly for DNA analyses and it can be coupled with parallel variables such as organic matter/particulate studies.



SAMPLES

Currently, we are applying our experimental proposal approach with samples from:

- **Blanes Bay Microbial Observatory:**
We will study the seasonal changes in surface waters of Blanes Bay, NW Mediterranean sea, in microbial diversity related to particle distribution. We will also compare our data with many other parameters and the historic series of the observatory.
- **NEMO cruise:**
Our samples will show the differences between coastal and open ocean waters in microbial diversity related to particle distribution in the NW Mediterranean Sea. We will also analyze differences in the vertical profile down to 2000m.
- **MALASPINA cruise:**
Our samples will describe global ocean changes in microbial diversity related to particle distribution.