JPI OCEANS

i-plastic

i-plastic

Dispersion and impacts of micro- and nano-plastics in the tropical and temperate oceans: from regional land-ocean interface to the open ocean

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icta

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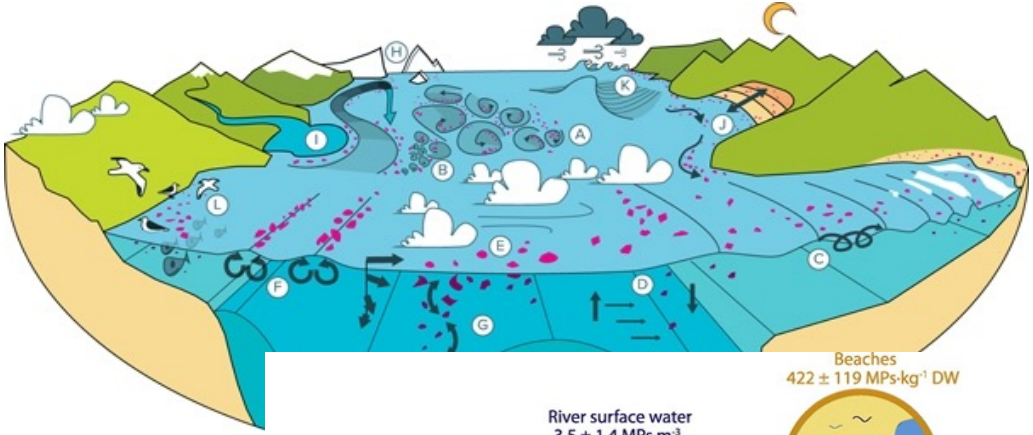
60 ANOS DE CONHECIMENTO DO OCEANO

UNIVERSITÀ DEL SALENTO

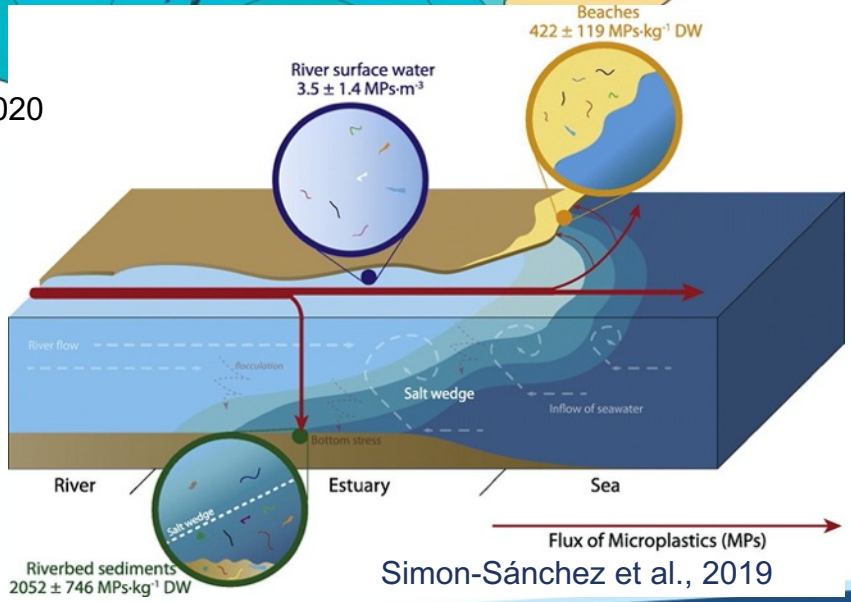
LabOmar Instituto de Ciências do Mar - UFC

MARE

i-PLASTIC MOTIVATION



van Sebille et al 2020



Simon-Sánchez et al., 2019

The Mondego estuary, Portugal (© Figueira from the sky)

Coastal processes, currents, surface waves and beaching
River plum, estuaries and delta
Extreme events
Transport and impact in biology

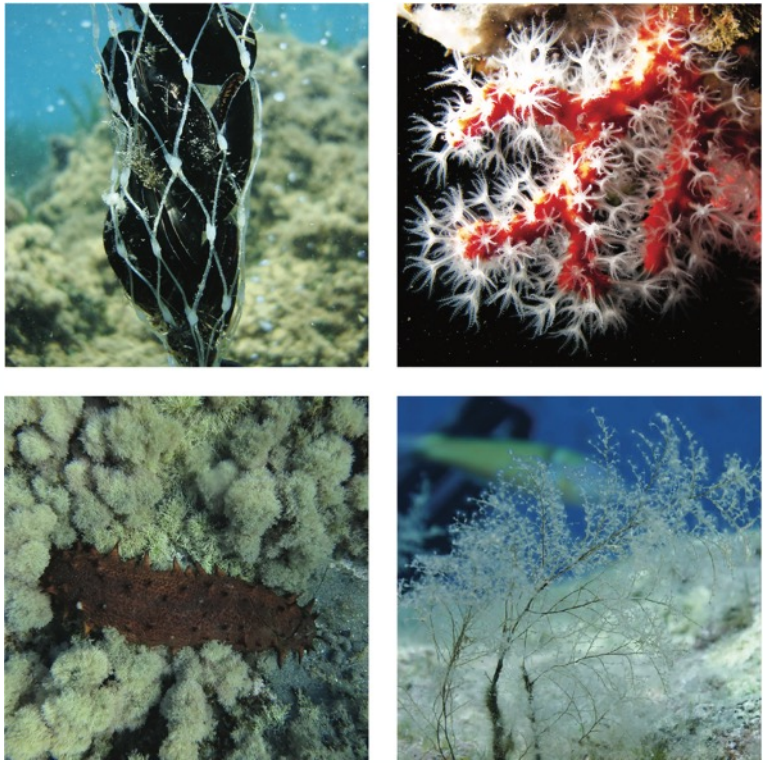
i-PLASTIC MOTIVATION

Fragmentation and degradation of macro-, meso- and microplastics drive in different coastal climatic systems

NPs quantification and environmental hazard

MPs effects on benthic suspension feeders

Retention abilities as well as the fate of MPs after ingestion by these organisms.



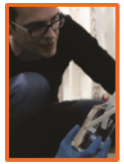
Example of organisms potentialy affected by MPs/NPs pollution: *M. galloprovincialis*, *C. rubrum*, *H. tubulosa* and *Eudendrium* spp.

i-plastic – AIMS

- To quantify the seasonal transport and dispersion of micro- and nano-plastics in three selected estuaries and adjacent coastal waters and shorelines under distinct flow and climate regimes (i.e., tropical and temperate systems).
- To test their impact on distinct commercially valuable species through in-situ observations and laboratory experiments.
- To detect and characterize nanoplastics in different environmental matrices and ascertain processes of macroplastic fragmentation.
- To feed regional models for the dispersion of micro- and nano-plastics with the data generated and to elaborate a model of their dispersion at the Atlantic scale.

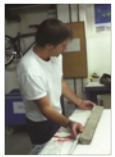
Consortium: 5 partners from 4 countries – Spain, Portugal, Italy and Brazil


P. Ziveri


M. Grelaud


J. García-Orellana


L. Simon-Sánchez


G. Mortyn

Monitoring and mapping of MPs
Nanoplastics characterization
Numerical modelling


P. Sobral


F. Bessa

Monitoring and mapping of MPs


S. Rossi


E. Mazzota


C. Malitesta


S. Fraissinet


G. De Benedetto


M. Licciano

Effects on marine biota
Mechanisms of MPs fragmentation
Nanoplastic characterization


M. Oliveira-Soares


R. Martins


T. Tavares

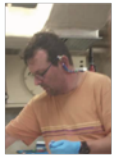

C. Teixeira


T. Martins


R. Cavalcante

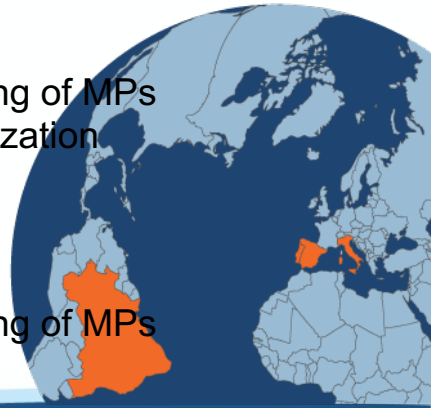
Monitoring and mapping of MPs
Nanoplastic characterization
Numerical modelling


C. Palma

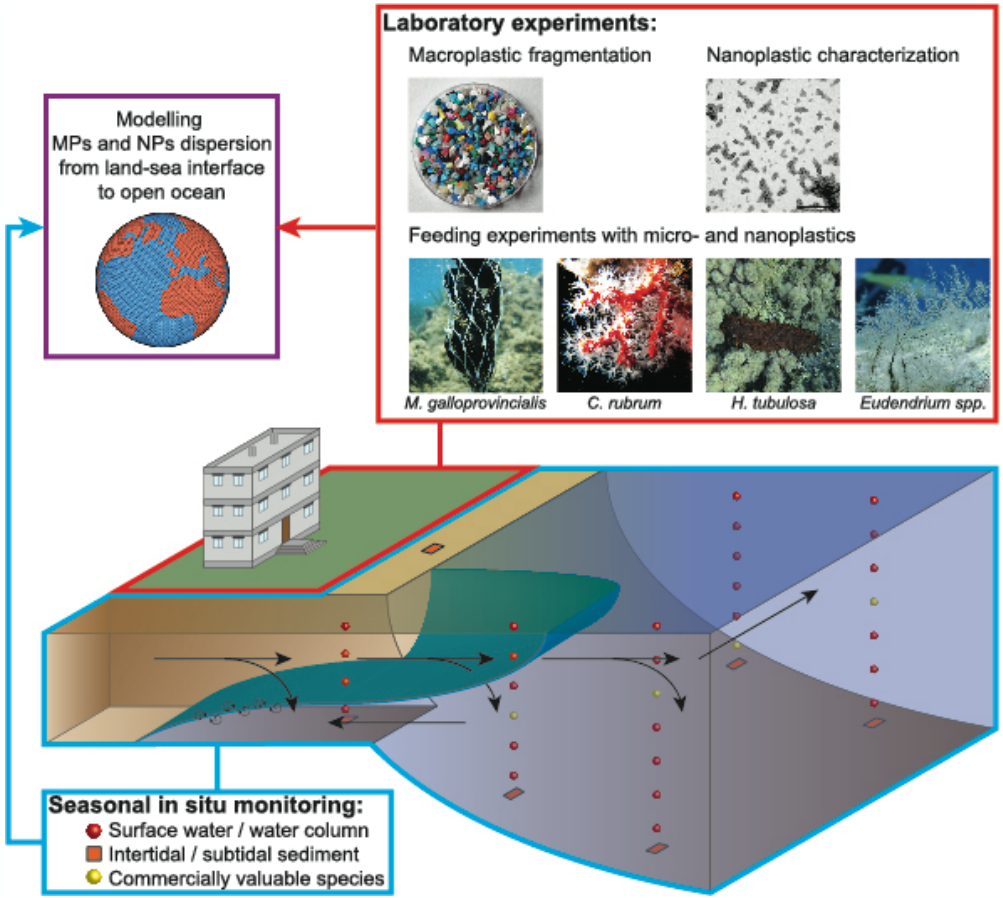

C. Borges


C. Rocha

Monitoring and mapping of MPs



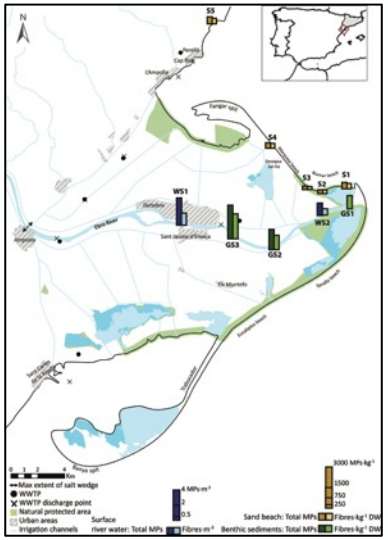
i-plastic approach



- WP1: monitoring and mapping of MPs
- WP2: Effects on marine biota
- WP3: Mechanisms of macroplastics fragmentation
- WP4: Nanoplastics characterization
- WP5: Numerical modelling
- *WP6: Data management*
- *WP7: Project management*

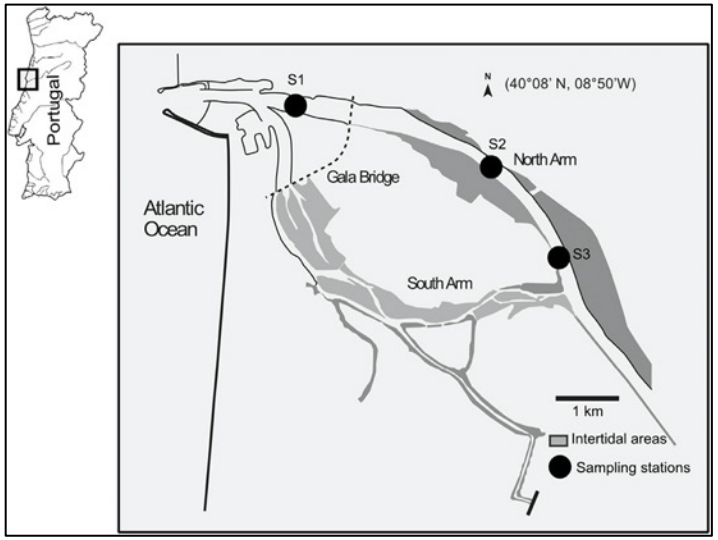
WP1: Monitoring and mapping of MPs

Ebro river



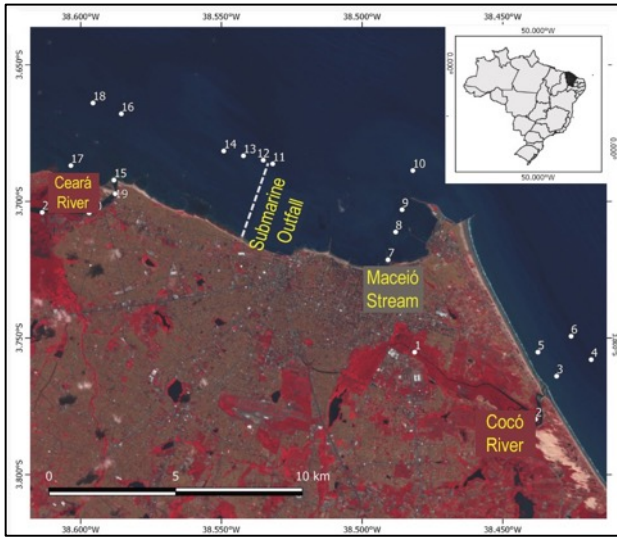
Simon-Sánchez et al., 2019

Mondego river



Bessa et al., 2018

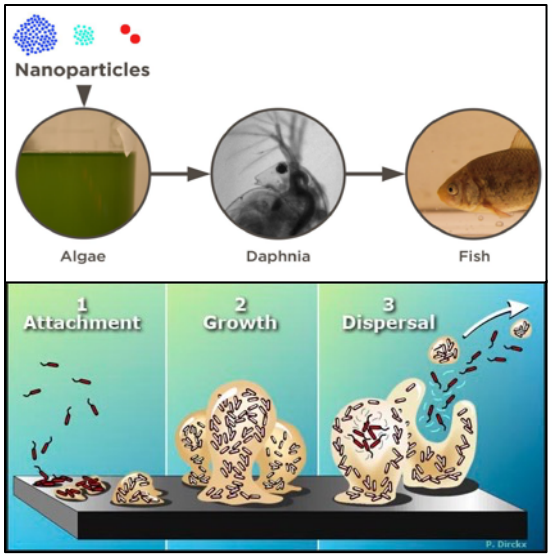
Cocó and Ceará rivers

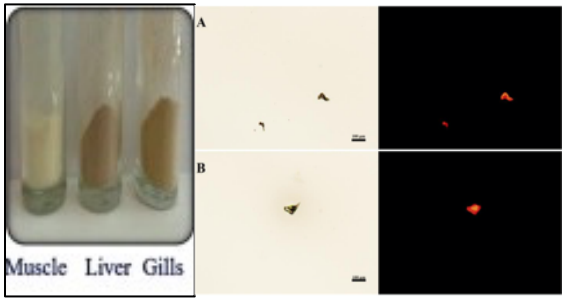


- Seasonal monitoring of the fluxes of microplastics: characterization of MPs abundances and mass (size, shape, colour, and polymer type) in surface waters, the water column, sediment, and biota samples from the estuaries and the adjacent areas.

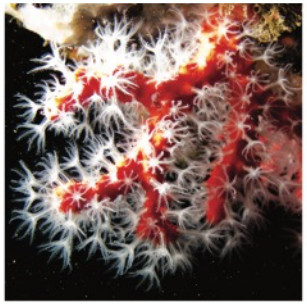
- Map the regional distribution/fluxes of MPs.

WP2: Effects on marine biota





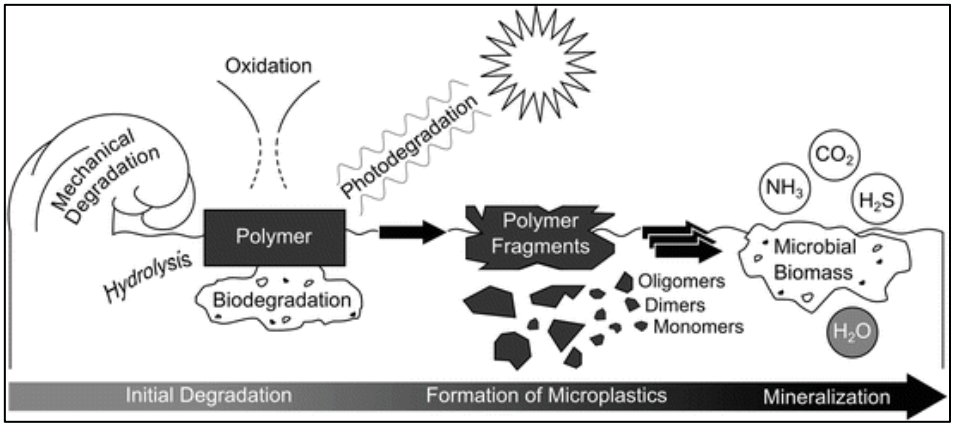
Lv et al., 2019

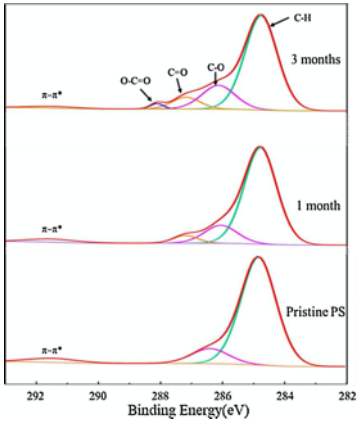


- 3 species of commercial interest: *M. galloprovincialis*, *C. rubrum* and *H. tubulosa*.
- Long term (12 months) feeding experiments with different amounts of MPs and NPs similar to those found in seabed sediment samples.
- Calcification, excretion, respiration, gonad output, quantity of organic matter, MPs/NPs content and residence time, lipid content and composition will be tested.
- Development of a rapid and effective method of digestion of the different tissues of marine organisms of interest.
- Microwave based digestion method for the different organisms and to minimally degrade plastics.

WP3: Mechanisms of macroplastics fragmentation

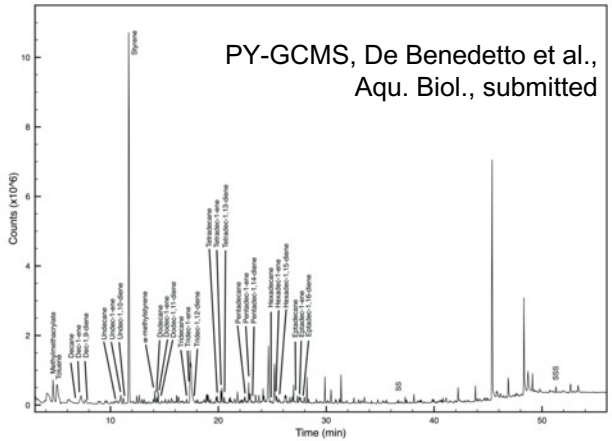
- The degradation mechanisms operating the reduction of macro- to micro- and nano-plastics will be investigated using both artificially and naturally weathered samples.
- Polymer interaction with the environment will be studied mainly by X-Ray Photoelectron spectroscopy.
- Kinetics of surface biofilm formation.
- Estimation of fragmentation time-scales.



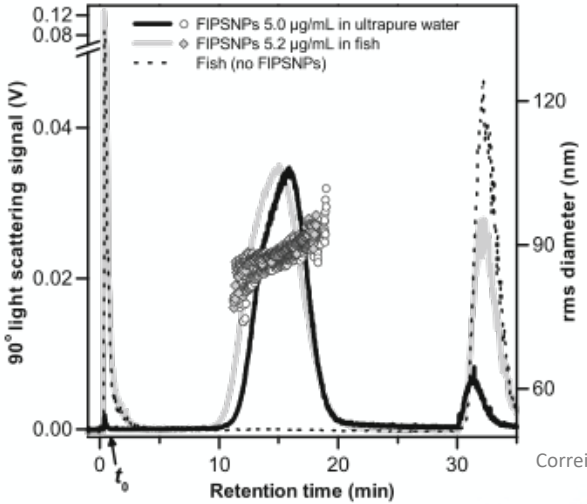


Mao et al., 2020

WP4: Nanoplastics characterization



De Benedetto et al., submitted



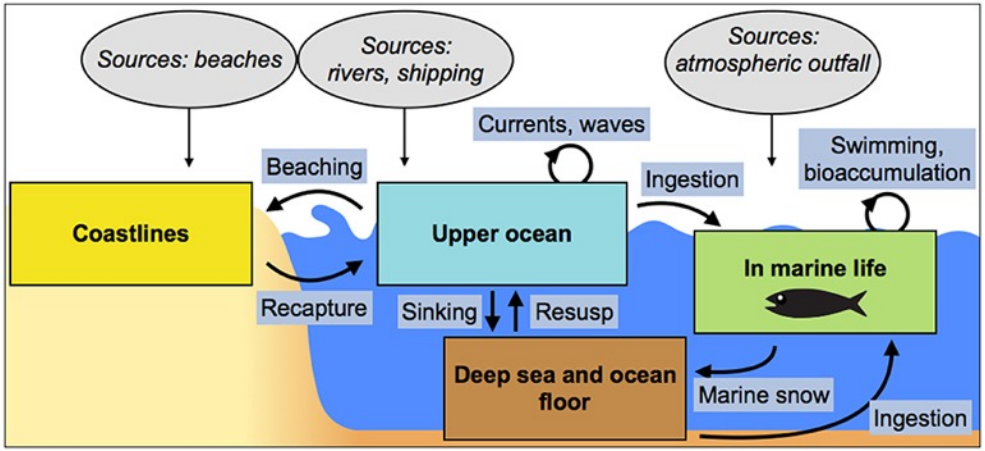
Correia et al., 2018

- Along with spectroscopic techniques such as µRaman and µFTIR, the identification of low range microplastics will be pursued by Py-GCMS. The potential of FFF in the nanoplastics detection will be also investigated.
- Laboratory and field samples.
- Qualitative and quantitative information.

WP5: Numerical modelling

- Assessment of the transport of plastics from the estuaries to the shelf and towards the open ocean by implementing the Regional Ocean Model System (ROMS) to supply the ocean circulation for OpenDrift.
- Paths and behaviour of MPs within the continental shelf and its exchange with the open ocean.
- Large scale transport of plastics within the Atlantic Ocean and Mediterranean Sea by the circulation provided from the Mercator Global Model.

Circulation used in the OpenDrift Lagrangian particle model in a backward and forward model to address the destination of the MPs that leave a particular shelf region and the sources of MPs in a shelf region.



Hardesty et al., 2017

WP6: Data management

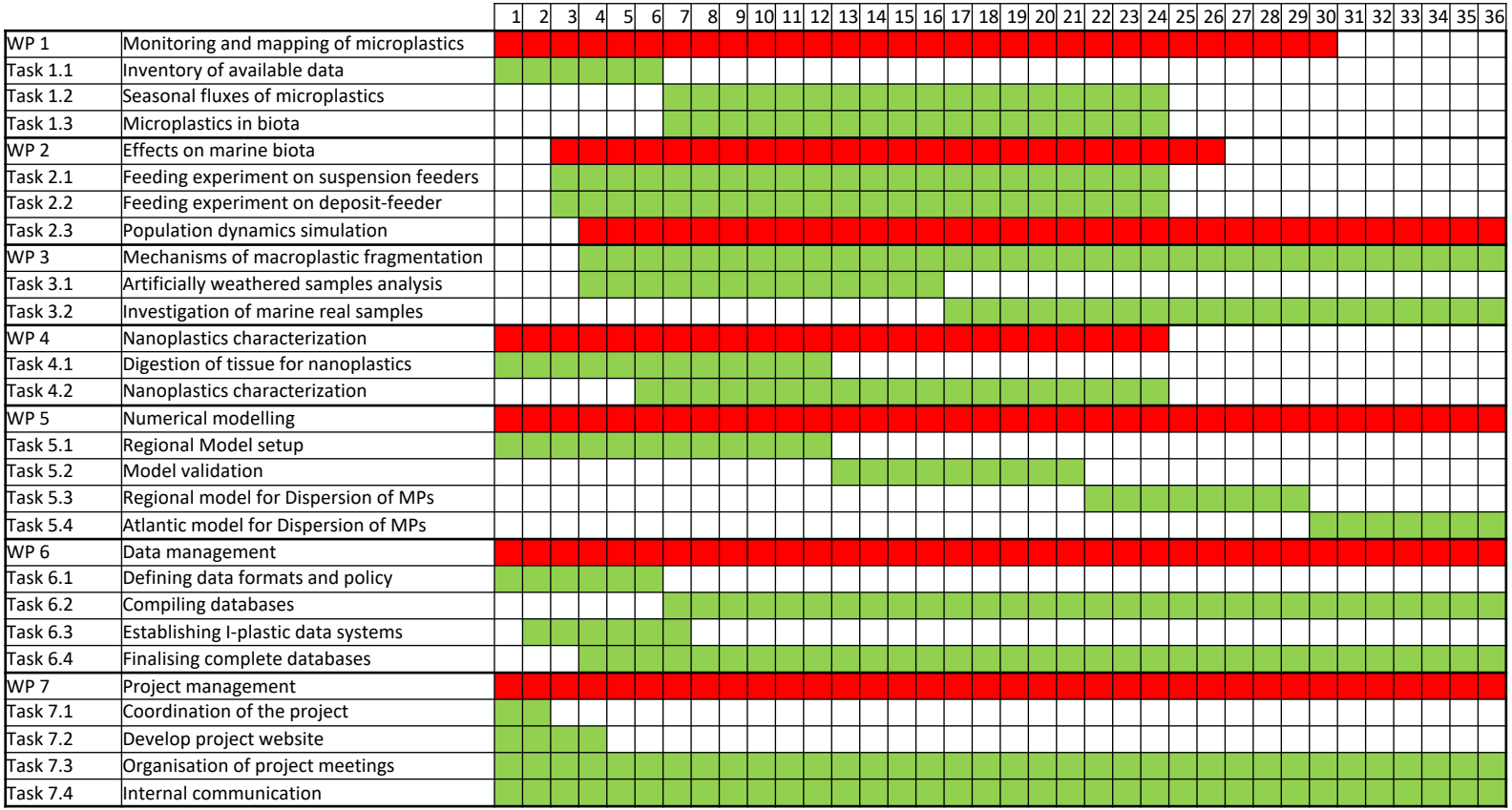
Concept of FAIR data - data that is Findable, Accessible, Interoperable and Re-usable:

- Defining the proper formats and protocols to organize, collect and archive the data generated.
- Collected and organizing existing data according to the defined formats.
- Guaranteeing the data flow between WPs.
- Making available the complete database generated during the project to the overall community

WP7: Project management

- To establish the internal detailed management and networking structure to reach the i-plastic project scientific objectives.
- To design, build and maintain a web-based portal for communication.
- To run the general financial aspects with full accountability.
- To link the i-plastic project to other international and national research programs on marine micro- and nano- plastics.

Timeline



Due to Covid-19 and in agreement with the national representatives and the partners, i-plastic will start on the 1st of September 2020

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THANK YOU

Patrizia Ziveri