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From citizen science to jellyfish dispersion models and molecular studies: tracking the progress of jellyfish science in Malta (Central Mediterranean)

Following participation within the 1980"s FAO-mediated monitoring exercises of *Pelagia noctiluca* blooms within Maltese waters, little scientific effort was invested in studying the dynamics of jellyfish blooms within same waters and at developing management and public information strategies concerning the same blooms. A renewed scientific effort at studying such aspects within Maltese waters was registered from 2010 onwards, with the launch of the Spot the Jellyfish citizen science campaign (www.ioikids.net/jellyfish) which provided a user-friendly, multivalent and web-based through which maritime stakeholders and the public at large could submit their jellyfish records for Maltese waters. The web-based portal was also supported by other promotional initiatives in the field, such as the installation of seaside boards on beaches. Through this initiative, several previously-undocumented species of gelatinous plankton were recorded for the first time from the same waters, including *Rhopilema nomadica*, *Aequorea forskalea, Porpita porpita, Discomedua lobata, Geryonia proboscidalis, Neotima lucullana, Physophora hydrostatica, Chrysaora hysoscella* and *Oceania armata*. The maintenance of an updated jellyfish record database has been made possible through the conduction of such a citizen science initiative.

As of 2012, the University of Malta has embarked on participation within the MED-JELLYRISK project (www.jellyrisk.eu) and this has enabled the development of a smart phone application (MED-JELLY), available for different smart phone operating systems, in Malta, Italy, Spain and Tunisia, as well as the installation of anti-jellyfish nets within the same geographical area. As a result of its participation within the same project, the University of Malta has coordinated the development of a jellyfish dispersion model, which consists of a hydrodynamic model coupled with a particle-tracking Lagrangian mode,l and used in order to simulate both surface water circulation and the transport and diffusion of numerical particles, proxy of jellyfish, inside the area of interest. Besides providing a 4-day forecast for the trajectory of a jellyfish bloom, the developed system can also provide a

hindcast for the same trajectory, using archived values for a set of hydrodynamic and biogeochemical parameters still generated through the hydrodynamic model.

The system was integrated into a Graphical User Interface which will allow users to define the position in time and space of a hypothetical bloom found in the Maltese waters, to select the amount of particles to simulate the jellyfish biomass and to launch the trajectory model run. The output will consist on both the geographical positions of each seeded particles within the area of interest and along the whole duration of the simulation and on the impacted coastal areas. Besides being launched by the user, the application can also be launched automatically once optimum conditions for the blooming of a single jellyfish species arise.

The genetic characterisation of different populations of *Carybdea marsupialis* sampled within a number of Maltese yacht marinas is currently being performed. Samples of the same species from Tunisia and Spain are being used as outliers for comparative purposes.