

Synergy between citizen science and artificial intelligence: The case study of *Grampus griseus* in the Northern Ionian Sea

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The Jonian Dolphin Conservation (JDC) is an association involved in scientific research aiming to study Cetaceans populations in the Gulf of Taranto (Northern Ionian Sea, Central-eastern Mediterranean Sea). JDC has started its scientific activities with a broad project of Citizen Science (CS), promoting since 2009 collaborative initiatives between scientists (Department of Biology, University of Bari and Institute of Intelligent System for Automation (National Research Council ISSIA- CNR) and volunteers (i.e students and citizens) on board of two 40ft catamarans specifically designed as observation platforms for monitoring dolphins and whales. Both catamarans are equipped with HD video imaging systems devoted for photo-identification study and hydrophones for bioacoustics studies. The number of boarded volunteers is about 10.000 per year and the survey effort is of about 200 days per years, with 6-7 hours per day. When an enormous amount of information was collected the organization and analysis of data request a key role by Statistics and Artificial Intelligence. In particular, as consequence of CS activities, sighting data and geo-referred photos of the Risso's dolphin *Grampus griseus* (Cuvier, 1812) have been collected in the Gulf of Taranto from 2013 to 2016 allowing to define its spatial distribution and site fidelity in the basin. Remarkably, although the Risso's dolphin is widely distributed from the tropics through the temperate regions in both hemispheres, the species is ranked as Data Deficient by IUCN Red List in the Mediterranean Sea. Thus, the need of a more comprehensive understanding of its spatial and temporal distribution and habitat use is very urgent mostly considering the requirements under the UE Habitat Directive, Marine Strategy Framework Directive (MSFD) and Maritime Spatial Planning Directive (MSPD). Citizen Science provides an opportunity to enhance long-term research, with unprecedented insights into the spatial distribution of *G. griseus* in the Northern Ionian Sea (Central-eastern Mediterranean Sea). An automated identification tool within a novel photo-identification method was applied on the Risso's dolphins, which show white scars of their dorsal fins as possible fingerprints. The tool requires no user's interaction and the system can process multiple images in a single run, overcoming the constraints of the state-of-the-art photo-identification tools. A total of 60 Risso's dolphins were identified and univocally catalogued. This result corroborates the hypothesis of a resident population of *G. griseus* showing site fidelity in a relatively restricted area of the Gulf of Taranto. The availability of this promising identification tool make possible the challenge of understanding the migration pattern and residency of the Risso's dolphins within the Mediterranean Sea and on global scale. As a result, the citizen science is a cost-effective means of carrying out broad scale cetaceans monitoring and represent an essential milestone to raise awareness on the marine biodiversity in terms of ecosystem services and socio-cultural heritage provided.

Keywords: citizen science; artificial intelligence; photo-identification; Risso's dolphin