New opportunities from citizen science for conservation assessments of the Mediterranean shark populations

Bargnesi Filippo[1,3], Cerrano Carlo[1], Serena Fabrizio[2], Gridelli Stefano[3], Moro Stefano[4] and Ferretti Francesco[5]

[1] Department of Life and Environmental Sciences, Polytechnic University of Marche, Via Brecce Bianche sn, 60131 Ancona, Italy
E-mail: f.bargnesi@pm.univpm.it
[2] Italian National Research Council, Mazara del Vallo,, Via Luigi Vaccara 61, 91026 Mazara del Vallo (TP), Italy
[3] Cattolica Aquarium, Parco delle Nazioni 1A, 47841 Cattolica (RN), Italy
[4] Department of Statistical Sciences, Sapienza University of Rome, Piazzale Aldo Moro 5, 00158 Roma, Italy
[5] Hopkins Marine Station, Stanford University, 120 Ocean View Blvd, 93950 Pacific Grove (CA), USA

Sharks are among the most endangered group of animals in the world, and in the Mediterranean Sea they have shown steep declines both in coastal and pelagic ecosystems. Of the 40 species of sharks occurring in the Mediterranean Sea, 57% are classified by the IUCN as threatened (vulnerable, endangered and critically endangered), of which 30% are critically endangered. This regional status is higher than the global figure where only 16% of the species are threatened and 2% are critically endangered.

Because of their low population density, contemporary records of Mediterranean sharks are often so scattered in space and time to make these species under detectable with conventional survey records. Hence developing tools to obtain and interpret data from alternative data sources such as citizen scientist programs involving fishermen, scuba divers, sailors, surfers and other ocean users represent important opportunities for detecting increasingly rare shark species. This is the aim of the sharkPulse project, a Stanford global initiative with the scope of filling the data gap characterizing global shark abundance and distribution from sightings supported by photographic evidence. Currently, sharkPulse has worldwide aggregated over 5000 sighting records of 268 species. Here we illustrate this program for the Mediterranean Sea. We will show how this program is organized in the region and how its data can be used for conservation.

These data may update most of the IUCN sharks' assessments for rare species in the Mediterranean Sea, including up-listing 13 species from data deficient to assessed. Furthermore, old photos, like ones found in historical public or private archives, matched with historical ecology reports and museums evidence are helping us to characterize the historical occurrence of many shark populations in the region. The angel shark (*Squatina* sp.), for example, is now listed as critically endangered in the Mediterranean Sea as it has strongly declined, and in some cases disappeared from most of its historical range in the last century. Our data suggest angel sharks have still geographic strongholds in the Mediterranean and NE Atlantic. These sites could represent important conservation opportunities for preserving the last individuals of these species and planning recovery programs.

Finally, creating sighting record networks for detecting the presence and inferring the conservation status of sharks is extremely important to accelerate the conservation of this important group of marine animals both in the Mediterranean Sea and worldwide. SharkPulse is moving in this direction by building an integrated system with local national focal points and collaborating with other monitoring programs assembling shark occurrence records like the GFCM's MEDLEM (General Fisheries Commission for the Mediterranean Sea, MEDiterranean Large Elasmobranch Monitoring) project. We will illustrate an example of this integration work by showing the case of the great white shark (*Carcharodon carcharias*) currently considered critically endangered in the Mediterranean and Europe. We observe that sharkPulse is able to detect records in areas in which MEDLEM has low sampling effort and, because of its smart conception, can quickly provide updated data to the latest sightings.

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