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Social media: a valuable tool to inform shark conservation in Greece

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Abstract

Sharks in the Mediterranean Sea are facing an elevated risk of extinction; several species are considered endangered and some have been reduced to such low population numbers that they are hard to detect through conventional monitoring methods. The recent emergence of new technologies, such as social media, makes it easier to collect and transmit information that may contribute to the conservation of endangered species. From 2017 – 2019 we carried out a project in Greece that searched social media (i.e. Facebook, Twitter and YouTube) postings with the aim of collecting data on the occurrence and basic biological parameters of sharks in the country and their interactions with fisheries. We recorded 116 social media postings referring to sharks in Greece, of which, 100 were identified to the lowest taxonomic level; sixty four percent of these postings referred to threatened sharks, while the majority of them referred to species that had not been evaluated for the Greek Red Data Book. Sharks occurred throughout the country, were often involved in negative fishery interactions and were rarely reported to have been released back to the sea. Endangered sharks were often misidentified as commercially valuable species. Our study highlights the importance of social media as a valuable tool in collecting baseline information, while identifying and/or focusing on important conservation issues about sharks in Greece.

Keywords: Citizen science; fisheries interactions; eastern Mediterranean Sea; species conservation.

Introduction

Global biodiversity has been in constant decline recently (Butchart *et al.*, 2010); species extinction, and in particular, the loss of terrestrial and marine megafauna may have strong effects on ecosystem function (Malhi *et al.*, 2016). Among the taxonomic groups that have been strongly affected by the recent biodiversity crisis are sharks, that have experienced significant population losses globally (Davidson *et al.*, 2016). Shark populations in the Mediterranean Sea have been particularly impacted, as studies indicate that some species of large sharks might have declined 96 – 99.99% relative to their former abundance (Ferretti *et al.*, 2008), leading to 50% of all Mediterranean sharks and rays to face an elevated risk of extinction (Dulvy *et al.*, 2016). This is of particular conservation concern, due to the slow growth, late age of maturity and low fecundity of this taxonomic group (Myers & Worm, 2005). The principal extinction driver for sharks in the Mediterranean Sea is overfishing, with most species considered a valuable bycatch (Dulvy *et al.*, 2016).

The most recent update on the number of sharks inhabiting the southeastern part of the Mediterranean Sea (i.e., including Greece) has been reported as 42 (Dulvy *et al.*, 2016). However, there are concerns regarding this species list, due to misreports in scientific literature and the fact that some sharks species, either are currently absent from Greek waters, or in low densities and therefore not possible to be detected anymore during conventional monitoring surveys (Damalas & Megalofonou, 2012; Follesa *et al.*, 2019). So far, the lack of quantitative population assessments has impeded shark conservation in the Mediterranean Sea (Ferretti *et al.*, 2008). For most species, fisheries-dependent data may be considered the sole tool for obtaining important scientific information on sharks in Greece (Damalas & Megalofonou, 2010, 2012; Damalas & Vassilopoulou, 2011); it is therefore of utmost importance to consider other ways of collecting information on sharks in Greece, that will inform in a timely and scientifically-sound manner their conservation.

The emergence of new technologies that make it easier to collect and transmit information has enabled volunteers participating in citizen science programs to collect

Table 1a. Descriptive information of the social media postings on sharks collected in Greece (2017 – 2019), including the number (*N*) of postings, the species they referred to and their conservation status according to the IUCN threatened status and the Red Data book of Greece and the type of the encounter with the shark.

N	Species	IUCN Threatened Status Mediterranean assessment	Red Data Book Greece	Encounter type
		Threatened Species		
4	*Alopias superciliosus*	Endangered	Not Evaluated	3 fishing, 1 stranded
5	*Alopias vulpinus*	Endangered	Vulnerable	5 fishing
2	*Carcharhinus plumbeus*	Endangered	Endangered	2 fishing
1	*Carcharodon carcharias*	Critically Endangered	Endangered	1 fishing
1	*Cetorhinus maximus*	Endangered	Vulnerable	1 swimming free
1	*Dalatias licha*	Vulnerable	Not Evaluated	1 fishing
14	*Isurus oxyrinchus*	Critically Endangered	Critically Endangered	10 fishing, 1 swimming free, 3 trade
1	*Lamna nasus*	Critically Endangered	Critically Endangered	1 fishing
14	*Mustelus mustelus*	Vulnerable	Not Evaluated	11 fishing, 1 swimming free, 2 trade
1	*Mustelus punctulatus*	Vulnerable	Not evaluated	1 fishing
2	*Odontaspis ferox*	Critically Endangered	Not Evaluated	2 fishing
3	*Oxynotus centrina*	Critically Endangered	Critically Endangered	3 fishing
15	*Prionace glauca*	Critically Endangered	Vulnerable	6 fishing, 1 stranded, 4 swimming free, 3 trade
		Near Threatened Species		
1	*Scyliorhinus stellaris*	Near Threatened	Not Evaluated	1 fishing
		Least Concern Species		
21	*Hexanchus griseus*	Least Concern	Not Evaluated	11 fishing, 1 stranded, 9 trade
7	*Scyliorhinus canicula*	Least Concern	Not Evaluated	2 fishing, 2 stranded, 3 trade
		Data Deficient Species		
2	*Heptranchias perlo*	Data Deficient	Vulnerable	1 fishing, 1 trade
3	*Hexanchus nakamurai*	Data Deficient	Not Evaluated	1 fishing, 1 stranded, 1 trade
2	*Squalus blainville*	Data Deficient	Not Evaluated	2 fishing

more data and cover wider areas, faster than researchers alone would, and all of this at a lower cost (Dickinson *et al.*, 2012). These facts make citizen science programs indispensable to terrestrial and marine research and conservation efforts in Greece (Giovos *et al.*, 2016; Bonnet Lebrun *et al.*, 2020). Most recently, the increase in the use of social media, has unwillingly enabled thousands of people to potentially contribute to the conservation of endangered species (Sullivan *et al.*, 2019).

Social media has been used previously in Greece to collect information on the status of specific elasmobranchs (Giovos *et al.*, 2018; 2019; 2020). Considering however the dearth of information on sharks as a group, the overarching goal of this study was to use social media in order to inform the overall conservation of sharks in Greece, specifically through exploring Facebook, Twitter and YouTube posts about sharks. We aimed at a) collecting data on the occurrence of different shark species and basic biological parameters (e.g., sex, age, weight, length), and b) collecting baseline information on shark – fisheries interactions. The results of our study are discussed in view of the conservation status of sharks in the country.

Methods

All data for this study were obtained from the social media platforms Facebook, Twitter and YouTube following their terms and conditions for protecting their users. Monitoring sharks (i.e., Elasmobranchii, Infraclass Selachii) in Greece was carried out by searching regularly for the following hashtags “Καρχαρίας”, “Καρχαριοειδές”, “Γαλέος”, “Σκυλόψαρο”, “Αλεποκαρχαρίας”, “Σμπρίλιος”, “Σαπουνάς”, “Προσκυνητής” and “Εξαβράγχιος” (Note: all the hashtags used in the study are used in Greece as local common names for the word shark or are the names of some of the most common species). The use of hashtags made it easier to search and filter information from the web (Kim *et al.*, 2016). In Facebook and YouTube the hashtag search occurred every 2-3 days, using the filter “Date posted” in order to identify the most

Table 1b. Descriptive information of the social media postings on sharks collected in Greece (2017 – 2019), including the species they referred to and additional information related to the postings, referring (whenever available) to the maturity stage, sex and the approximate total length, weight and depth at which the shark was potentially caught.

Species	Additional Information
	Threatened species
Alopias superciliosus	1 adult of 3 m length
Alopias vulpinus	1 specimen of 200kg, caught at 130m depth; 1 juvenile female of 1m length, weighing 15kg; 1 adult female of 2m length, weighing 200kg
Carcharhinus plumbeus	1 adult female weighing 75kg, caught at 33m depth
Dalatias licha	1 adult caught at 612m depth
Isurus oxyrinchus	2 specimens weighing 20 and 19.5kg respectively; 1 specimen caught at 140m depth; 1 juvenile female of 0.8m length, weighing 5kg, caught at 70m depth
Mustelus mustelus	4 specimens weighing 10, 25, and 30kg respectively, 1 adult female caught at 14m depth; 1 adult female of 1m length; 1 adult female of 0.8m length, weighing 2kg
Oxynotus centrina	1 adult female of 0.4m length, caught at 118m depth
Prionace glauca	1 specimen of 4kg; 1 specimen weighing 2kg, caught at 90m depth; 1 specimen of 5kg, caught at 36m depth; 1 juvenile male; 1 adult female of 2.5m length
	Near Threatened species
Scyliorhinus stellaris	1 juvenile of 0.5m length, caught at 55m depth
	Least Concern species
Hexanchus griseus	1 specimen of 200kg; 1 juvenile weighing >150kg; 1 juvenile female of 2.5m length, weighing 220kg; 1 adult female of 5m length, weighing 400kg; 1 adult weighing 300kg
	Data Deficient species
Heptranchias perlo	1 juvenile male caught at 237m depth
Hexanchus nakamurai	1 adult female of 4m length, weighing 436kg

recent posts. In Twitter searching for shark-related information occurred once a week. Every social media posting was followed up publicly, by contacting the people who had made the posts, in order to verify shark sightings and to collect, if possible, additional information: we tried to collect detailed information on the species [including information on the sex, maturity stage, size and weight of the individual(s) and potentially the depth at which they were caught], the date, location and circumstances of the sighting and the fate of the sharks. We used in the study only postings where the species of the observation was identified independently by two experienced observers.

Results and Discussion

From 2017 – 2019 we recorded 116 social media postings referring to sharks in Greece; in 100 cases the shark referred to in the posting was identified to the lowest taxonomic level. Sixty four (64%) of these postings referred to threatened sharks (i.e., 13 species classified as Critically Endangered, Endangered and Vulnerable according to the IUCN Red Data List), 1 (1%) to a Near Threatened species, 28 (28%) to two species of Least Concern and 7 (7%) to three Data Deficient species, according to the IUCN shark assessment for the Mediterranean Sea (IUCN, 2020) (Table 1a). The majority of the shark species reported in social media postings had not been evaluated for the Greek Red Data Book (Table 1a), partly because of a lack of accurate data (Megalofonou, 2009). The observations of the sharks in these postings were located throughout Greece (Fig. 1) and all species had been recorded recently in the country (Papaconstantinou, 2014). Baseline information on the maturity stage, sex, length, weight and depth at which sharks were potentially caught were recorded for 12 species (Table 1b).

The majority of the postings (86%) collected during the study referred to animals, either caught during fishing or traded at fish markets/restaurants. Only a small percentage (5%) of sharks caught by professional fishers was reportedly released back to the sea. The effect of fishing on shark stocks has become the focus of considerable international and national concern (Megalofonou, 2009; Dulvy *et al.*, 2016). The results of our study indicate that fishing continues to affect endangered sharks in the region, which, if not controlled, could pose a significant threat to the conservation of sharks in Greece. The low percentage of sharks that were reported to have been released is an indication of the lack of knowledge, by both professional and recreational fishers, on the legal and conservation status of sharks and of their importance for marine ecosystems.

During data collection we recorded 22 cases where sharks were misidentified by fishers [most commonly as *Galeorhinus galeus* (N = 7) and as *Cetorhinus maximus* (N = 7)]. Misidentification of sharks is not uncommon in Greece (Giovos *et al.*, 2020) and is most likely related to some degree to unintentional misidentification due to lack of expert knowledge, both by fishers and competent authorities (Giovos *et al.*, 2020), but also to deliberate

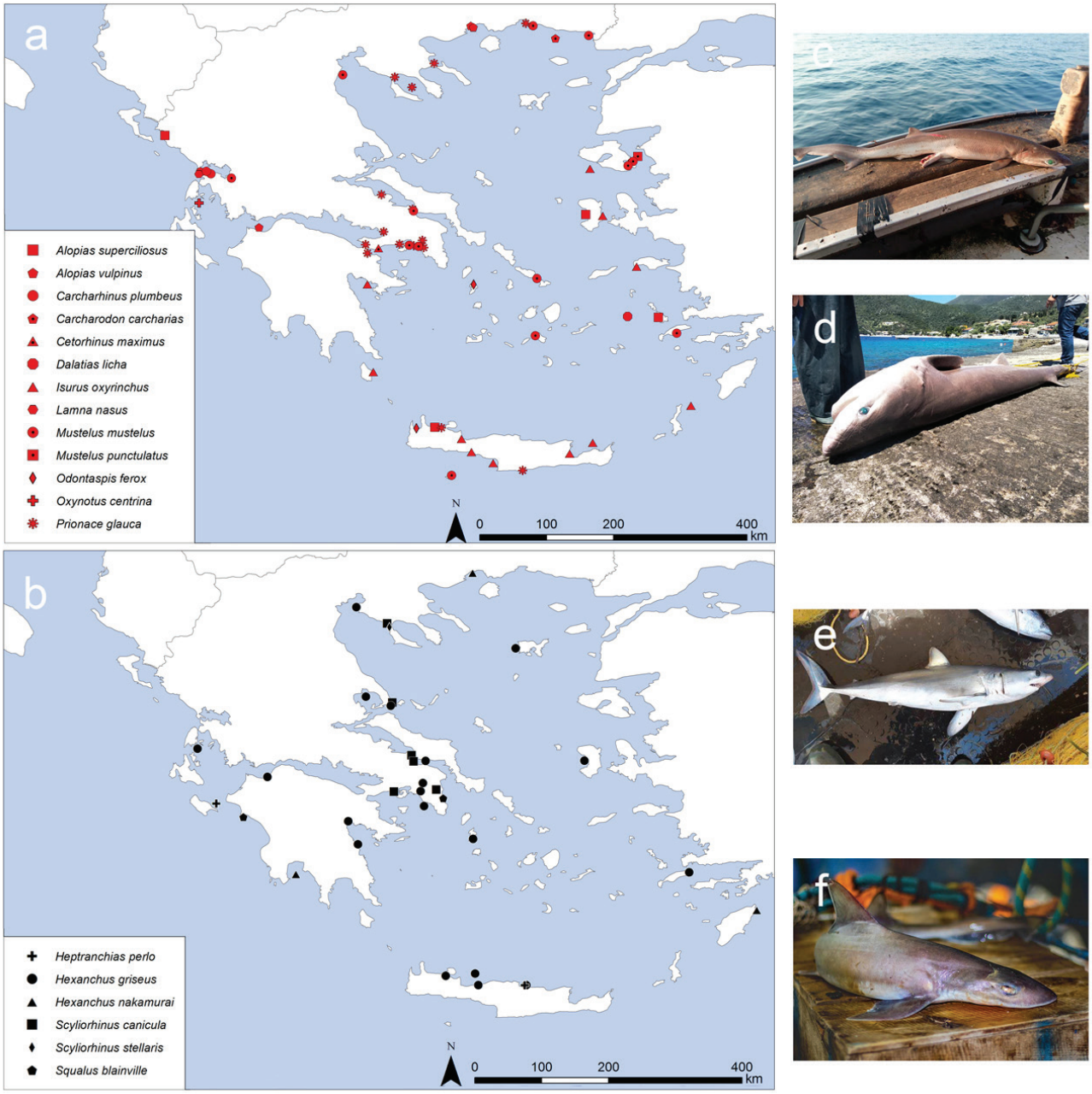

Fig. 1: Map indicating the location of 100 shark observations reported through social media postings in Greece (2017–2019) and 4 characteristic photographs of sharks from these postings. a) Locations of threatened sharks; b) Locations of non-threatened sharks; c) *Heptranchias perlo* from Zakynthos Island; d) *Hexanchus griseus* from Leukada Island; e) *Isurus oxyrinchus* from Chios Island; f) *Mustelus mustelus* from Lesvos Island.

substitution with the aim of providing a way for prohibited/protected sharks to enter the supply chain and to be sold to consumers (Pazartzi *et al.*, 2019; Giovos *et al.*, 2020). This fact, in conjunction with the low percentage of sharks released back to the sea with international and/or national trade restrictions indicates a lack of enforcement of shark-specific legislation.

Social media is used to share information with a broad public audience and has been accepted as an innovative tool for scientists to engage the public in outreach and conservation efforts (Bik & Goldstein, 2013; Sullivan *et al.*, 2019). Information gleaned from social media posts may be particularly beneficial for species that are difficult to monitor effectively across their range, resulting in many financial and logistical hurdles to overcome in order to monitor a population (Witmer, 2005; Tulloch *et al.*, 2013). We believe that this is particularly the case for sharks in Greece. The results of our study add baseline knowledge on the occurrence of sharks in the country, while identifying and/or focusing on important conservation issues, such as the negative effects of fishing, the lack of implementation of shark-specific legislation and the misidentification of sharks in order to enter the local shark trade. On the other hand, the approach of using social media to inform conservation comes with shortcomings (e.g., misidentification of sharks by non-experts, inexact reporting of sighting locations or poor quality of photographs that makes proper species identification

difficult), which should be taken into account when developing scientific monitoring programs.

Considering that most information on sharks in Greece originates from surveys of fishing operations that are not carried out on a day-to-day basis, we believe that the monitoring of social media posts provides a valuable alternative to collecting important information for the conservation of sharks in Greece. Considering that most pelagic sharks are migratory species and that their effective management will require reliable data that can reflect migratory patterns (Megalofonou *et al.*, 2005), we believe that international efforts, such as the Mediterranean Elasmobranch Citizen Observations (https://www.facebook.com/theMECOproject/) and Shark Pulse (http://baseline3.stanford.edu/SharkPulse/), that take advantage of the information provided by citizen scientists on social media benefit shark conservation. Such efforts should connect with scientific monitoring programs, such as the Mediterranean Large Elasmobranch Monitoring database (Mancusi *et al.*, 2020) and strive to link science with effective shark conservation in the eastern Mediterranean Sea.

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