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Human–Shark Interactions: Citizen Science Potential in Boosting Shark Research on Madeira Island

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Abstract: Sharks are regularly considered to be an indicator of the ocean ecosystem's health and are generally difficult to study in their natural environment. Citizen science has been increasing, being a cost-effective method for particularly important species that have low encounter rates or are logistically challenging to sample. Madeira Island has a considerable gap in terms of its coastal shark species data and studies, which this work aims to complement. To achieve this goal, online questionnaires to citizens and specific interviews of spearfishers were conducted, with questions related to species size, distribution, and behaviour. Exactly 129 reports of shark sightings were obtained, including seven different species exhibiting four different types of behaviour around the coastal areas of the different municipalities of Madeira Island. Individuals seem to aggregate around the east and west edges of the island due to localised upwelling phenomena. Also, a relation was found between size and distance to coast and depth, as smaller sharks tend to stay close to the shore, probably reflecting the role of Madeira as a nursery area, but further studies are necessary to confirm the reliability of this hypothesis.

Keywords: sharks; East Atlantic; coastal area; distribution; behaviour

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1. Introduction

Sharks are crucial for marine ecosystems, are frequently considered an indicator of the overall ocean ecosystem's health [1,2], and are generally difficult to study in their natural environment. Since multiple shark species are apex predators, they have a crucial role in the food chain, preying on sick, weak, and older individuals [2,3]. In this context, the maintenance of the carbon cycle in the ocean is also affected by sharks, since they help to cycle the carbon present in dead organisms that are on the bottom of the ocean [1].

Over the last decade, despite being continuously harvested for food [4,5], the economy of several countries, such as Australia, Maldives, French Polynesia, and even the Azores, have also benefited from the rise and growth of a new ecotourism industry focusing on shark watching and diving, providing jobs and enabling more opportunities for local businesses and giving new meaning and value to human–shark interactions [6–8].

However, as most shark populations are declining, this thin natural balance has been hampered by major impacts on the ecosystem and underlying species [9–11]. Overexploitation of shark species is currently a global problem that is leading to the decline of many populations, and there are high mortality levels due to fishing above sustainable levels [5,12]. Hence, nowadays, these charismatic species are considered a priority for research, monitoring, and conservation worldwide due to their importance to ecosystems, vulnerability to fishing pressure, especially considering their life traits (e.g., slow growth, late attainment of sexual maturity, long life spans, low fecundity), and high exploitation rates by both direct and indirect (bycatch) fisheries [2]. Once feared, currently, these species are considered conservation "ambassadors" that foster ocean and reef conservation, global public awareness, economic support for conservation campaigns, and even, the creation of protected marine areas [13,14].

Citizen science arose in the 1980s, as many discoveries were made by more wealthy citizens who had the time and resources to allow them to travel and make their own autonomous experiments and observations [15]. In the following years, people's awareness increased, mainly due to the constant media attention focused on environmental problems such as global warming and increases in the quantity and quality of nature-based documentaries actively pursuing participation in research campaigns to act on these environmental problems [15,16]. Hence, globalisation, technology development, increased awareness, and overall increases in life quality and expectations (mainly in developed countries) have made citizen science available to many more people worldwide.

In the last two decades, citizen science has been increasing considerably, and this public involvement in science provides scientists with important data that can potentially be used in scientific research [16–18]. Nowadays, citizen science has become so vital for research that according to [16], only with the contribution of citizen scientists can most projects that aim to collect field data through a wide area of the globe succeed.

The use of citizen science in sharks is mostly related to recreational divers and snorkelers who collect information about abundance, distribution, and movement [19,20], as sharks are increasingly being seen by the diving community as one of the most desired animals in terms of photography [15]. Considering that there has been growth in marine wildlife tourism and because the availability and accessibility of waterproof cameras and smartphones is growing, it is becoming increasingly important to try to gather information from general citizens [21,22]. However, fishing and fishermen have already been used in citizen science approaches [23].

Citizen science has also proven its importance as a cost-effective method, particularly in areas that are logistically challenging, when monitoring charismatic species such as the whale shark (*Rhincodon typus*) [16,21,24], for example, in the Philippines, the Arabian Gulf, or Ningaloo Reef, Australia [16,21,24]. This species is particularly suitable for marine wildlife tourism and citizen science programs, because of its predictable aggregations [25–27].

While some shark species are well-known to the diving community and are more frequently encountered, as is the case for the whale shark and tiger shark (*Galeocerdo cuvier*) in the Northeast Pacific, some are more difficult to find and are less focused on due to their lower encounter rates and sightings [15,21,28]. This difference happens for many reasons, for example, some shark species may occur more frequently offshore or in deeper waters (e.g., *Prionace glauca* in the Azores [8] or *Carcharhinus amblyrhynchos* in the Sudan [19]) making it difficult to maintain consistent monitoring campaigns, since there is a low success rate for encountering sharks over an extensive area [21,29].

Hence, citizen science can provide a better understanding of the fundamentals of government decisions, as in the case of the management plan for the tope shark (*Galeorhinus galeus*) in Canada in 2012, where public feedback was requested [15], granting public involvement and awareness. The rapid decline of shark populations worldwide has increased the need to obtain local ecological knowledge and conduct scientific analyses of critical habitats. Information on the presence, abundance, and distribution of sharks is therefore required to identify priorities and streamline policy advice for their sustainable management at the national and regional levels, enhancing the importance of citizen science for maximising conservation efforts over these elusive and key species [30,31].

Even though there is considerable diversity of and knowledge on sharks in Portugal [32–35], so far, in the Madeira archipelago, there is not much information and few studies on these species. Apart from the few annotated checklists and new reports [36,37], there are only two studies related to the biology of two deep-sea shark species, *Deanira profundorum* and *Centrophorus squamosus* [38,39], and one study on parasite fauna in *C. squamosus* [40].

This study aims to address the large knowledge gap regarding coastal shark species occurring near Madeira Island using citizen science data. In this sense, Local Ecological Knowledge (LEK), referring to the cumulative knowledge held by local communities about an ecological system, emerged as a logical approach for this study [41–44].

Specifically, this work aims to consolidate our understanding of the current and historical distribution and habitat use of shark species along the Madeira Island coast. We used observations made by the coastal community and stakeholders from a wide range of coastal activities to elucidate the number and location of potential essential habitats focusing on different key questions: (1) What are the most frequently observed species and their distributions through the coast? (2) How does the frequency of observations fluctuate based on the time of the year and location? (3) Is there any location that tends to form aggregations by size? (4) What is the most frequent size seen in the different coastal species? (5) Are there relations among the shark size, observation frequency, distance from the coast, and depth of observation? (6) What type of behaviour is more frequently observed for each species?

2. Material and Methods

2.1. Study Area

All sighting reports were obtained around the coastal area of Madeira Island, located in the Northeast Atlantic at 32.7° N, 17° W (Figure 1). The water temperature is high, fluctuating between 17 °C and 23 °C throughout the year and is considered oligotrophic and translucid and has few nutrients in its suspension [45,46]. The predominant winds are from the northeast for most of the year (from January to March, June to August, and October to December). They are predominantly from the northwest in May and the north in September. In April, the predominant winds come from both from the north and the northwest [45]. Regarding waves, the dominant directions are from the west, northwest, and north, with no major waves coming from the southern side. During the summertime, waves from the northeast and east also become more significant [47]. The archipelago is mainly affected by four superficial oceanic currents that are integrated into the general circulation of the North Atlantic current system: the Azores current, the Canaries current, the Portugal current, and the North Equatorial current [45].

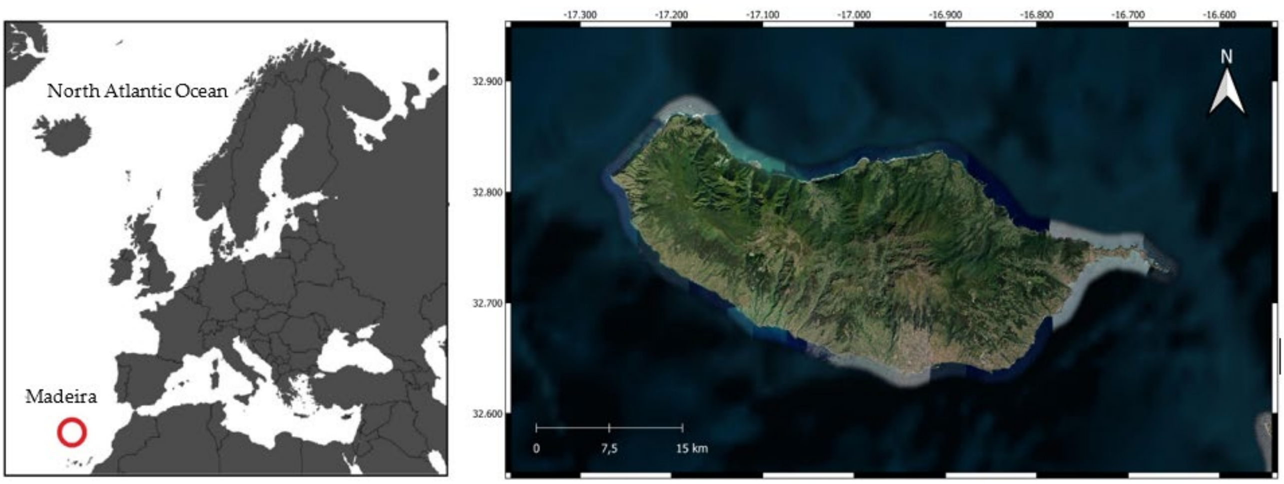

Figure 1. Madeira Island's location in the Atlantic.

This island has a volcanic origin with a seabed that is mostly rocky and uneven in coastal areas. The south coast has a narrow island platform and is more protected from the predominant winds and waves, contrary to what happens on the north coast [47–49].

Since the continental shelf is absent, the depth of the seabed increases significantly, and the habitat availability for coastal species is negatively affected by this absence [50].

For this study, the island was divided according to its municipalities into 10 sections, as seen in Figure 1.

2.2. Data Acquisition

The sighting reports were all obtained through occasional observations made by local citizens while performing different types of activities, essentially in two different ways, through an online questionnaire and direct interviews. The online questionnaire was open to the general public for completion between March and May of 2022 and was composed of 11 questions with the aim of obtaining information about the species, distribution, time of the year, observation frequency, maximum number of sharks seen per report, type of activity that the observer was performing, distance to the coast, depth, location, seasonality, size, behaviour, and the duration of the interaction.

In addition to the questionnaire, personal interviews exclusively directed toward spearfishers were also conducted during the same period to obtain more elaborate data regarding shark observations and behaviours. The questions performed during the interviews were like those presented in the online questionnaire. However, there were additional questions about the types of interactions of the sharks with spearfishers, the equipment used, and the catches.

2.3. Species Selection and Size

Species were selected (Table 1) according to the information available about coastal shark species present around Madeira Island [37]. A total of seven shark species were considered: *Galeorhinus galeus*, *Mustelus mustelus*, *Sphyrna zygaena*, *Deania calceus*, *Prionace glauca*, *Carcharhinus obscurus*, and *Isurus oxyrinchus*. In the online questionnaires, despite these species being quite easy to identify and distinguish by islanders who actively use the coast and know its marine resources, two strategies were employed: First, the local common vernacular name of the species was included in the questionnaire, and images and links for the species were also included. Furthermore, citizens would only click on a specific species if they were sure; otherwise, they could simply click on the "other" option in the questionnaire.

Table 1. Size categories and the maximum lengths of the different shark species.

Species	Small	Large	Maximum Length	Length at First Maturity
Mustelus mustelus	<1 m	≥1 m	2 m	0.90 m
Sphyrna zygaena	≤2 m	>2 m	4 m	2.65 m
Prionace glauca	<2 m	≥2 m	4 m	1.99 m
Galeorhinus galeus	≤1 m	>1 m	1.95 m	1.44 m
Deania calceus	≤60 cm	>60 cm	1.27 m	0.98 m
Carcharhinus obscurus	≤2 m	>2 m	4.20 m	2.5 m
Isurus oxyrinchus	≤2 m	>2 m	4.45 m	2.78 m

Regarding size, two categories were created for the different species, juveniles (immature, small) and adults (mature, large), according to the length at first maturity. The Fishbase platform (www.fishbase.de) was accessed on 3 April 2022 to obtain the categories for each species [51]. Table 1 presents this information.

2.4. Maximum Number of Sharks per Sighting, Sighting Frequency, and Seasonality

To evaluate the maximum number of sharks observed per sighting, data were grouped in four categories, labelled from 1 to 4. The same process was conducted to evaluate the sighting frequency using categories of between 1 and 5 times per year, between 5 and

10 times a year, between 10 and 20 times a year, and more than 20 times a year, as well as according to each season.

2.5. Depth and Distance from the Coast

Three categories of depth were selected to perceive the distribution of the data relating to the location depth at which the sighting took place. The categories formed were, respectively, between 0 and 10 m, between 10 and 30 m, and at depths of more than 30 m, as estimated by the citizen according to the activity performed near the coast. The same process was conducted for the distance from the coast using three categories: between 0 and 50 m, between 50 and 300 m, and more than 300 m.

2.6. Behaviour

Behaviour was classified according to the literature in the following categories [52–54]:

- Active swimming—The shark swims very actively without significant changes in its direction;
- Agonistic behaviour—The shark is very active, swimming relatively quickly with frequent changes in its direction. Overall, this is a behaviour response to a stressful situation;
- Milling—The shark swims slowly, changing direction frequently;
- Knifing—The shark swims on the surface with its dorsal fin out of water.

2.7. Statistical Analyses

A data matrix was created in Excel with the collected data. Since the data were not homogeneous, non-parametric tests were used to understand whether the data distribution was significantly different according to the variables tested. At this stage, a comparison by the pairwise method was used to understand in more detail which pairs of categories displayed significant differences between each other. Also, the Chi-Square test was performed mainly in the absence of significant differences in the distribution of the data through the use of the Kruskal–Wallis test. All tests were performed using IBM SPSS Statistics 27 software.

3. Results

From the questionnaire and the interviews, 129 records of shark sightings on Madeira Island were obtained from at least eight different types of activity: spearfishing (69), freediving (2), scuba diving (14), snorkelling (3), boat fishing (22), shore fishing (10), maritime/touristic activities (8), and from surfing (1). In total, there were confirmed sightings of the seven expected shark species: *M. mustelus*, *S. zygaena*, *P. glauca*, *G. galeus*, *C. obscurus*, *I. oxyrunchus*, and *D. calceus*.

3.1. Species

Considering the number of records by species, *M. mustelus* was the species with the highest percentage of records (46%), followed by *S. zygaena* (26%) and *P. glauca* (10%). The lowest number of records by species was registered for *D. calceus* and was unidentified with a percentage of 1% (Figure 2).

The distribution of species did not differ significantly among records through a Kruskal–Wallis test (H(7) = 7.00, p = 0.429). However, with the pairwise comparison method, significant differences were seen for the distribution of records between two species (*D. calceus*–*M. mustelus*: (H(7) = 2.05, p = 0.041). Also, significant differences between the number of records by species were found with the Chi-square test (X^2 = 179.65, df = 7, $p \leq 0.001$).

Most records were from small sharks (83) rather than large sharks (46). *D. calceus* was the only species that presenting with only smaller individuals. *Prionace glauca* had a higher number of large sharks reported (8) (Figure 3).

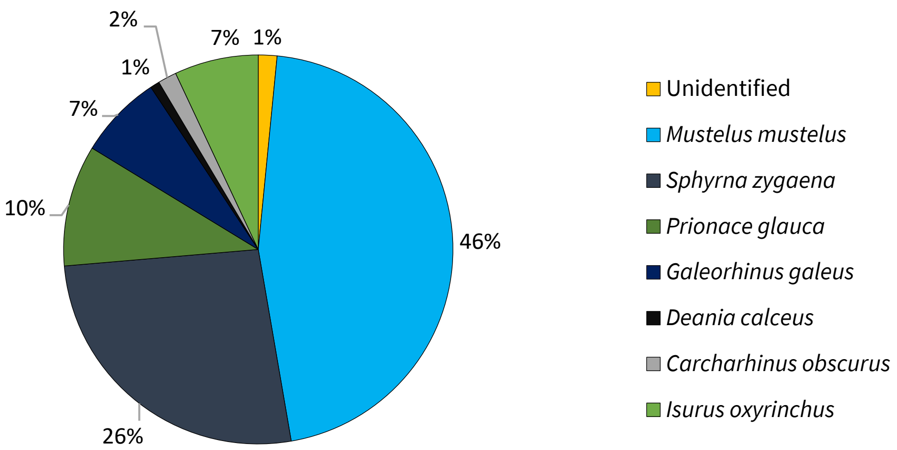

Figure 2. Percentage of records by species.

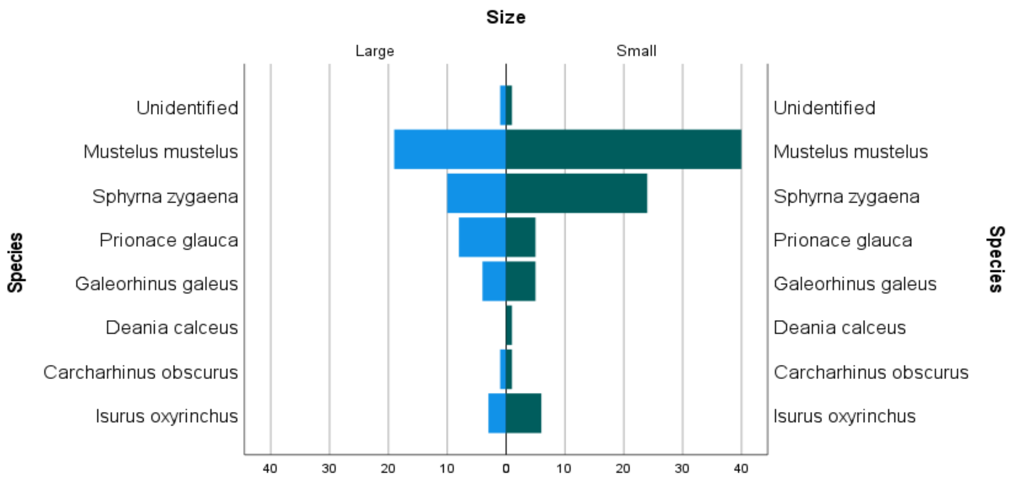

Figure 3. Sizes of the sharks by species.

3.2. Spatial and Temporal Distribution

Attending to the distribution of records through the locations, the municipality with most records of sharks was the municipality of Calheta (25), followed by Machico (23) and Funchal (18). The areas with the lowest numbers were Santana and Ponta do Sol with only five records. (Figure 4).

Attending to the pairwise comparison method, for almost every location, the distribution of the records was considered equal. We found two exceptions, Calheta-Santana and Calheta-Ponta do Sol, where the distribution of the records was considered to be significantly different (both: H(9) = 1.997, p = 0.046).

Specimens of *M. mustelus* were observed in all areas, with the highest frequency registered in the municipality of Funchal. Regarding *S. zygaena*, it was seen in all locations, except for Santana, Ponta do Sol, and Ribeira Brava, with Calheta being the area with the most sightings. *P. glauca* was seen in all locations with the exceptions of Santana, São Vicente, and Ribeira Brava, and the area with the highest number of records was Machico. Regarding *G. galeus*, it was observed only in Santana, São Vicente, Ribeira Brava, and Machico, with São Vicente being the area with the highest number of records. *D. calceus* was only observed in the São Vicente area, and *C. obscurus* was observed only once in the areas of Porto Moniz and Câmara de Lobos. Finally, *I. oxyrinchus* was observed in the areas of Calheta, Ribeira Brava, and Machico, with Calheta being the area with the highest number of records. Unidentified shark species were observed in Santa Cruz and Machico (Figure 5).

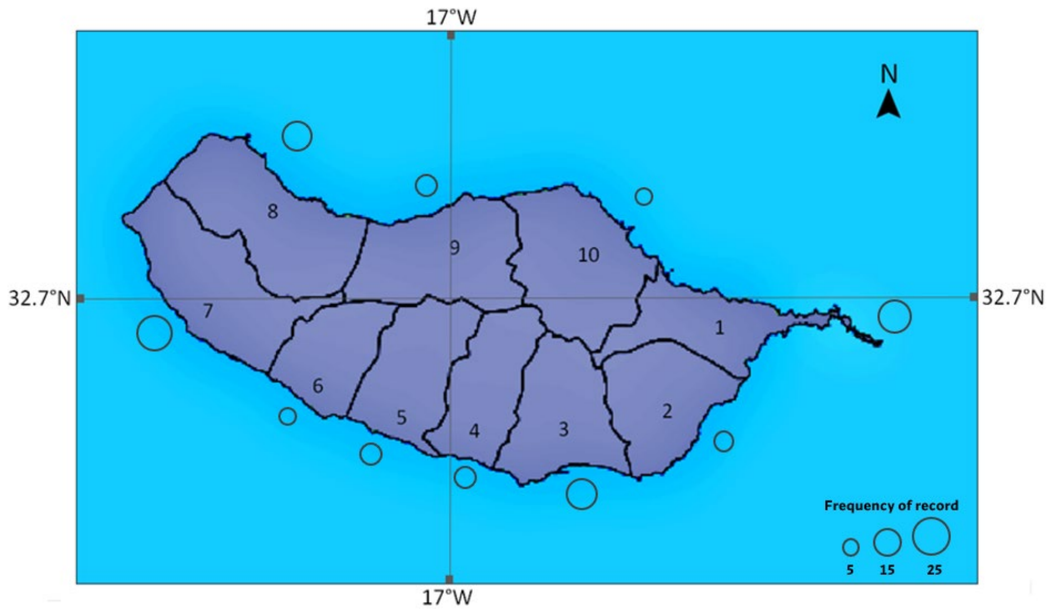

Figure 4. Madeira Island with the locations and frequencies of shark records: 1—Machico, 2—Santa Cruz, 3—Funchal, 4—Camara de Lobos, 5—Ribeira Brava, 6—Ponta do Sol, 7—Calheta, 8—Porto Moniz, 9—São Vicente and 10—Santana.

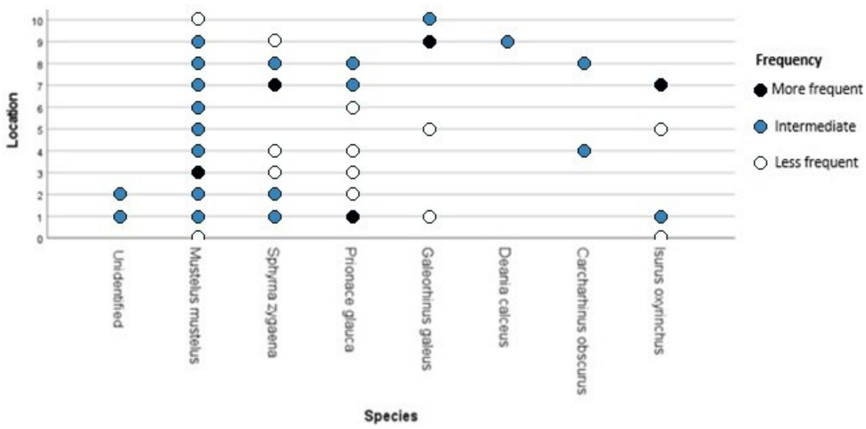

Figure 5. Distribution of the sighting records for each species by location: 0—Unidentified, 1—Machico, 2—Santa Cruz, 3—Funchal, 4—Câmara de Lobos, 5—Ribeira Brava, 6—Ponta do Sol, 7—Calheta, 8—Porto Moniz, 9—São Vicente, and 10—Santana.

Regarding the seasonality, more than half of the total shark records were obtained during summer (63%). Spring was the second most common season where more records were reported (15%), followed by the autumn (9%) and then winter (8%). About 5% of the records were from unidentified areas. Nevertheless, considering the number of sharks per sighting, the highest value occurred in winter with approximately three sharks for each sighting. During spring, the most frequent number of sharks per sighting was two, while in summer and autumn, it was one, differing significantly (winter–summer: H(4) = 2.35, $p = 0.19$).

Most sharks are found alone or in groups of two. In this context, the locations of Santana and Ponta do Sol displayed the smallest numbers of sharks per sighting. Although there were not many sightings in Ribeira Brava, this location displayed a high number of sightings where more than one shark was seen. Calheta was the location with more sightings of four or more sharks (four sightings), followed by Funchal (three sightings). In Machico, most of the observations contained one shark per sighting (Figure 6).

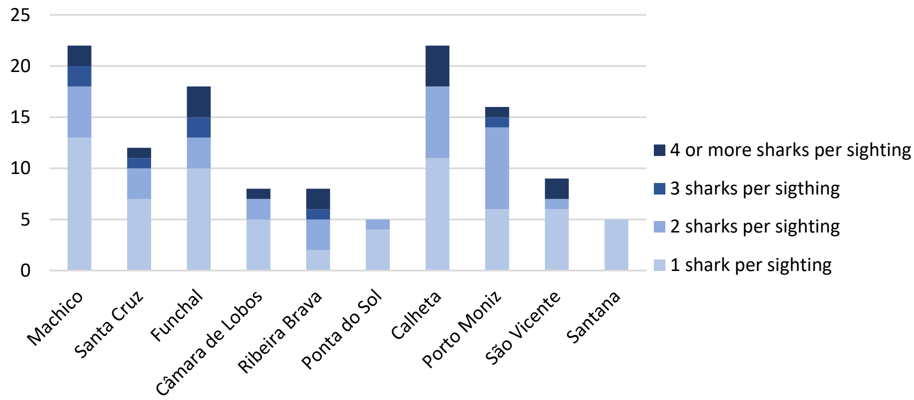

Figure 6. Maximum number of sharks by sighting per location.

The pairwise comparison method showed significant differences in the distribution of the maximum number of sharks observed by sighting per location: Santana–Calheta (H(10) = 2.06, p = 0.039), Santana–Porto Moniz (H(10) = 2.07, p = 0.038), Santana–Ribeira Brava (H(10) = 2.59, p = 0.010), and Ponta de Sol–Ribeira Brava (H(10) = 2.01, p = 0.040).

Regarding the depth, smaller sharks were sighted at all depth categories, while larger sharks were not observed in shallower grounds (less than 10 m). Sharks over 3 m were exclusively observed at greater depths, reflecting a positive relation between depth and shark size (Figure 7). Significant differences were obtained between the shark size and depth using the Kruskal–Wallis test (H(3) = 37.32, $p \leq 0.001$).

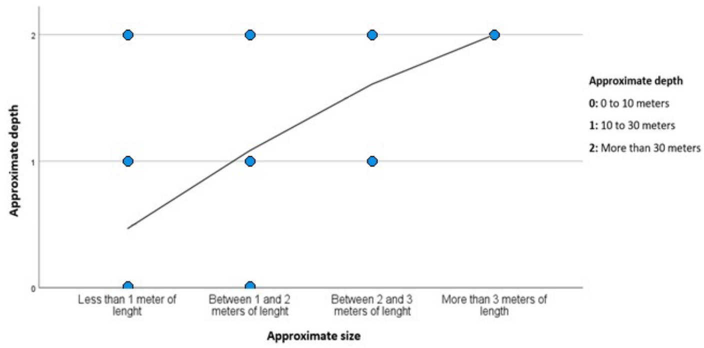

Figure 7. Variation in the size of the shark by the depth of the location.

A similar result was obtained when the shark size and coast distance were analysed (Figure 8). However, all shark sizes, except for the largest ones (more than 3 m), were observed in all distance categories (0 to more than 300 m). More than 3 m sharks were only seen at areas more than 300 m from the coast. Significant differences were obtained between the shark size and coast distance using the Kruskal–Wallis test (H(3) = 39.56, $p \leq 0.001$).

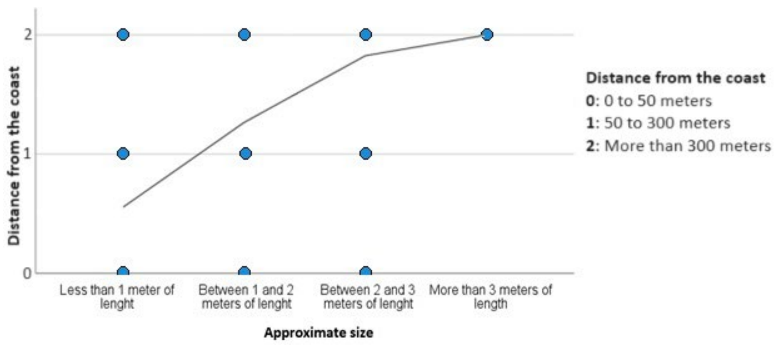

Figure 8. Variation in the size of the shark based on the distance from the coast.

3.3. Behaviour

The four different behaviours were registered. The behaviour that was mostly observed was milling, while knifing was the least commonly seen. *M. mustelus* and *G. galeus* mainly displayed milling behaviour, while knifing behaviour was not observed. All behaviour categories were seen for *S. zygaena*, with knifing being the most common. For *P. glauca*, only three categories were registered, with the most frequent being knifing. Regarding *D. calceus,* milling was the only behaviour observed, while *C. obscurus* only showed agonistic behaviour. *I. oxyrinchus* was sighted displaying multiple behaviours, with the most frequent being active swimming (Figure 9).

Figure 9. Types of behaviour observed in the different shark species.

Significant differences were seen through a Kruskal–Wallis test analysing the different behaviours of the species (H(7) = 43.47, $p \leq 0.001$). Using the pairwise comparison method, some categories of species showed significant differences. Some examples of compared categories with significant differences were as follows: *M. mustelus* differed significatively from *P. glauca* (H(7) = 2.96, p = 0.003), *S. zygaena* (H(7) = 6.09, $p \leq 0.001$), and *G. galeus* (H(7) = 1.10, p = 0.271). *S. zygaena* differed significatively from *C. obscurus* (H(7) = 0.12, p =0.909), and *G. galeus* (H(7) = 2.45, p = 0.014). Also, significant differences were found between *I. oxyrinchus* and *P. glauca* (H(7) = 0.57, p = 0.561).

4. Discussion

This study represents one of the first approaches to investigate the Madeira Island coastal shark species by evaluating the occurrence, distribution, population structure, and habitat. The results of this study show that coastal sharks are seen year-round.

More than half of the sighting records were obtained during spearfishing, an activity that is conducted regularly throughout the year around the coastal areas of the archipelago, which enhances the probability of shark encounters [55]. Also, the practice of spearfishing can attract sharks due to the presence of live bait, which therefore increases the chance of a sighting, especially in species that have more opportunistic feeding behaviours, such as *M. mustelus* and *P. glauca* [56–58].

Another aspect that must be considered is that interviews were conducted with spearfishers as well as the online questionaries, which could have positively influenced the number of records of this activity when related to others. Surfing was the activity where fewer sighting records were obtained. This was as expected, since a sighting would only be possible if the shark was near the water's surface. It can also be explained by the fact that this activity is only performed in specific shallow areas of Madeira Island. Also, surfing is considerably weather-dependent and does not occur regularly throughout the year [59].

4.1. Species

The species with the highest number of records was *M. mustelus* with 46% of the sighting records. It is, frequently seen during all seasons, forming juvenile aggregations nearshore, as reported by other authors [36]. The opportunistic behaviour of *M. mustelus* may also be a significant factor in explaining why this species is frequently seen near the coast, especially during fishing activities [57].

After *M. mustelus*, the shark species that had the highest number of sightings was *S. zygaena* (26%), followed by *P. glauca* (10%). Both species are described as being frequently observed in Madeira with some sightings of juveniles and small individuals near the shore, which can explain the considerable number of sighting records [36]. *Prionace glauca* has fewer sightings than *S. zygaena*, probably because the former is a pelagic oceanic shark that is not frequently seen in nearshore areas [56,60] like the Azores, where juveniles of hammerhead shark are frequently seen close to shore [33].

Galeorhinus galeus and *I. oxyrinchus* represented only 7% of the sightings. Considering that *I. oxyrinchus* is a highly migratory oceanic shark species that often does long migrations, it is not expected to occur near coastal areas [61–63]. Regarding *G. galeus*, although this species was described as a coastal and frequent shark [64], due to overfishing, it is classified as Critically Endangered on the IUCN red list [65], which might justify its low number of encounters. Also, it is a much more elusive species when compared to others.

The shark species with fewer sightings were *C. obscurus* (2%) and *D. calceus* (1%). While the first has a low natural abundance and is considered rare around the coastal waters of Madeira Island [66], *D. calceus*, although described as frequent throughout the year, is present at greater depths [67]. Hence, its sighting record probably resulted from bycatches of trawl fishing.

Regarding the shark size, for almost every species, there were more sighting records of small individuals. The same was evidenced by [66] with nearshore sightings of juvenile sharks of *M. mustelus* and *S. zygaena*, which may reflect the nursery role of Madeira for some of these shark species, as shallow coastal waters normally attract young sharks, reducing the risk of predation [68–70]. These areas provide refuge from predation by bigger sharks that normally prefer more offshore waters [71–74].

Prionace glauca was the only species that displayed more sighting records of larger sharks, which might be related to the presence of adult females between 27 and 32° N, while the juveniles, subadult females, and adult males were found farther to the north [1]. Also, during the spring and summer, adult females and males of *P. glauca* mate in the area between the latitudes of 32–35° N, so it would be expected that more adult (large) sharks would be seen in more coastal areas.

4.2. Spatial and Temporal Distribution

Regarding the sighting distribution in the coastal waters of the different municipalities, both the eastern (Machico) and western (Calheta) areas displayed high numbers of records. The flanks of Madeira Island are known for having localised upwelling processes and eddies of cold nutrient-rich waters that therefore improve the productivity of these areas, which may lead to a high number of sightings [45,75]. However, this may also be related to the sighting effort, since both areas are accessible to almost every activity and have marina harbours.

When comparing the south with the north, there were relatively more sightings in the south, probably due to the stronger winds and waves on the north coast, which reduce the sighting effort [45,47]. Another factor that might impact the sighting effort is the fact that the south coast has higher numbers of harbours and marinas [47].

Funchal is an area that has good port infrastructures and is not exposed to predominant winds and is therefore the area where *M. mustelus* was more frequently seen. *S. zygaena*, *P. glauca*, and *I. oxyrinchus* had more sighting records in the eastern and western locations of Madeira Island (Machico and Calheta), probably because these areas have higher levels of productivity due to the occurrence of localised upwelling processes [45].

Contrarily to most shark species, *G. galeus* had more sighting records in the north and was only seen in two locations (São Vicente and Santana municipalities). This result was unexpected due to the fact that this species is referred to as being frequent in the coastal areas [64] of Madeira Island [66].

Summer (63%) and spring (15%) had the most shark sighting records, probably due to the hypothesis that eddies with high concentrations of chlorophyll are more abundant around Madeira Island during late spring and summer when surface currents and trade winds are normally the strongest [45]. This leads to an increase in terms of the primary productivity (phytoplankton) that consequently positively affects the presence of sharks [76]. Apart from this factor, there are also more citizens performing coastal activities during summer, therefore increasing the effort.

In terms of the distribution of the maximum number of shark sightings per record, coastal areas that are near the west (Calheta and Porto Moniz) and east (Machico) coasts of the island had considerable numbers of records where more than one shark per sighting was observed. This may be another indication that sharks preferentially aggregate on the edges of the island.

However, the coastal area of Ribeira Brava has a comparatively low number of records but displays a high number of sightings where more than two sharks were observed, including two records where four or more sharks were seen. Although there is no clear evidence, this fact might be related to the presence of aquaculture cages, which may attract sharks for small periods and form aggregations around this fish farm [77,78].

4.3. Behaviour

Considering behaviour, almost every species, apart from *C. obscurus*, had sighting reports displaying milling behaviour, with this being the most frequent behaviour for *M. mustelus* and *G. galeus*. This result suggests that, overall, the shark populations on Madeira Island are not disturbed by the coastal activities practiced by its residents [79]. However, in the case of *C. obscurus*, there were only sighting reports where the agonistic behaviour was seen, reflecting a stress triggered response, which can affect the feeding, resting, and reproductive behaviour [52,79]. Nevertheless, more data are required to evaluate the reliability of this hypothesis.

Prionace glauca and *S. zygaena* displayed more frequent knifing behaviour, and this was only reported for these two species. This result was expected, as these species are frequently found in the epipelagic zone, and this behaviour is regularly seen in both species, with *P. glauca* sometimes having its dorsal fin out of the water for more than 7 min [53,54]. Active swimming was most frequently seen for *I. oxyrinchus*, considering that this species is known to often migrate over long distances and is highly mobile [63].

4.4. Conservation and Awareness

Since sharks urgently require improved and more efficient conservation efforts, these surveys can help scientists and policymakers to identify knowledge gaps and dispel misconceptions. They also serve as a blueprint for future initiatives, enabling effective awareness-raising, the alteration of public perceptions, and the creation of a societal resonance that enhances the adoption of management and conservation strategies. Given that the majority of the data come from fishers, there is a knowledge gap among different citizens that should and must be addressed.

While knowledge does not always guarantee positive actions and attitudes, it undeniably plays a vital role in shaping how people perceive things. Knowledge and awareness can stem from various sources, such as formal, informal, and non-formal education. Marine conservation projects are recognised for their ability to foster experiential knowledge. Documentaries are a significant source of information about sharks, followed by the web, books, and non-governmental organisations (NGOs). The accessibility of information through online videos or texts has proven to be a potent tool for conserving species that were previously misunderstood, like cetaceans [80].

5. Conclusions

Sharks are widely distributed around Madeira Island with the most abundant species being *M. mustelus*. There is a clear distinction in the distribution of sharks among different areas of Madeira Island with the coastal waters of the west and east flanks appearing to be more productive and consequently more susceptible to aggregations of smaller individuals. The presence of these smaller sharks suggests that this is a nursery or pupping area for some of the shark species considered in this study.

The observed behaviour suggests that most species appear to be undisturbed by situations that induce stress, apart from *C. obscurus*. Increased research endeavours and studies are necessary to delve into the convergence of the challenges facing fisheries and the vital functions of local habitats within the archipelago, particularly when facing the huge knowledge gap in the study area regarding these charismatic species. Engaging in citizen science provides the chance to acquire enduring data that hold value for both management and conservation purposes.

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