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Sperm whale individual exposure to whale-watching vessels in the Azores, using photo-identification

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1. ABSTRACT

Sperm whales are one of the major targets of the whale-watching industry in the Azores archipelago. Under the scope of a major project (Watch It) that aims to determine the effects of this activity on this large-sized odontocete, the present work studied the individual exposure of sperm whales to whale-watching vessels. A total of 2603 photographs were provided by whale-watching companies from Faial and Pico islands (collected in 2017 and 2018). Using photo-identification programmes the referred photographs were analyzed and, from their total, 2467 photographs turned into 750 distinct identifications. The summer months were the periods with highest identifications (both new and resighted individuals). About 78% of the identified sperm whales were only seen once and, within the resighted individuals, a great majority was re-observed with an interval of 1-3 weeks (along one year period). Furthermore, the 6 more frequently resighted individuals were mostly observed in the highest whale-watching intensity area, possibly being members of the same groups or social units. These individuals may be the ones under highest whale-watching pressure and it is essential to investigate further the effects of this activity on them.

2. INTRODUCTION

2.1 Marine mammals

Marine mammals are animals that have adapted their body shape and capacities, to live their whole lives in the aquatic environment (Chivers, 2009). Some of those adaptations are: the presence of a thick layer of blubber that contributes to temperature regulation, migration of the nose to the top of their heads that facilitates their breathing, and a slender and hydrodynamic body shape to help with swimming (Reidenberg and Laitman, 1987).

Within these, the order Cetacea (from Greek, *ketos*, and from Latin, *cetus*, which mean "sea monster" and "large marine animal", respectively) includes 3 suborders: Archaeoceti or "the ancient whales", Misticeti or "the baleen whales", and Odontoceti or "the toothed whales". The toothed whales include more than 70 live species of dolphins, porpoises and beaked whales (Leatherwood and Reeves, 1983; Martin and Reeves, 2002). They range in size from less than 1 m long for a newborn vaquita (*Phocoena sinus*), to 33 m of an adult blue whale (*Balaenoptera musculus*) and occupy water ranging in temperature from 2°C to over 30°C (Carwardine,1995). They also exhibit a diverse array of life history strategies, like the sperm whale (*Physeter macrocephalus*) that can remain beneath the water for over an hour and dive to depths of more than 1,000 m, or the gray whale (*Eschrichtius robustus*) which annually

migrates some 15,000 to 20,000 km between breeding and feeding areas (Teloni et al., 2008; Perrin et al., 2002).

2.2 The Sperm Whale

Sperm whales are widely distributed from the tropics to near the poles in both hemispheres, but females and males occupy different parts of this range (Whitehead, 2003). Females remain in tropical and temperate waters year-round, where they live in long-term social groups with their calves and juveniles (Lyrholm and Gyllesten 1998; Whitehead, 2003). Males separate from these social groups, as they approach puberty, and gradually move to higher latitudes (Whitehead, 2003). In their late twenties, males start migrating periodically to warmer waters that are inhabited by females, with a mating purpose (Rice, 1989).

The sperm whale is the largest of the toothed whales and the largest toothed predator. They are mostly dark grey, though some whales have white patches on the belly, and are the only living cetacean that has a single blowhole asymmetrically situated on the left side of the crown of the head. Their heads are extremely large, accounting for about one-third of total body length, with a narrow lower jaw. The portion of the jaw closest to the teeth is white, the interior of the mouth is often bright white and there are about 20-26 large teeth in each side of the lower jaw. Their skin just behind the head is often wrinkled and they have small dorsal fins that are low, thick, and usually rounded. The flippers are paddle-shaped and small compared to the size of the body and their flukes are triangular (Perrin et al., 2000).

These large-sized cetaceans possess natural markings in their flukes and dorsal fins that are unique and may be used for recognition of each individual, while observed at sea or through diverse image analysis protocols (Childerhouse et al, 1996).

2.3 Photo-identification and mark-recapture methods

Photo-identification is a non-invasive tool that can be used to obtain data about cetacean population dynamics which are essential for appropriate environmental management. It is based on recognition of individuals through natural markings that are recorded photographically (Arnbom, 1987).

Sperm whales are usually identified from their natural markings, mainly those located on the trailing edges of their flukes (Whitehead and Gordon, 1986). These markings accumulate with age but remain stable (Dufault and Whitehead, 1995). The flukes and their markings can be promptly photographed while the animals are arching at the beginning of dives (Fig. 1).

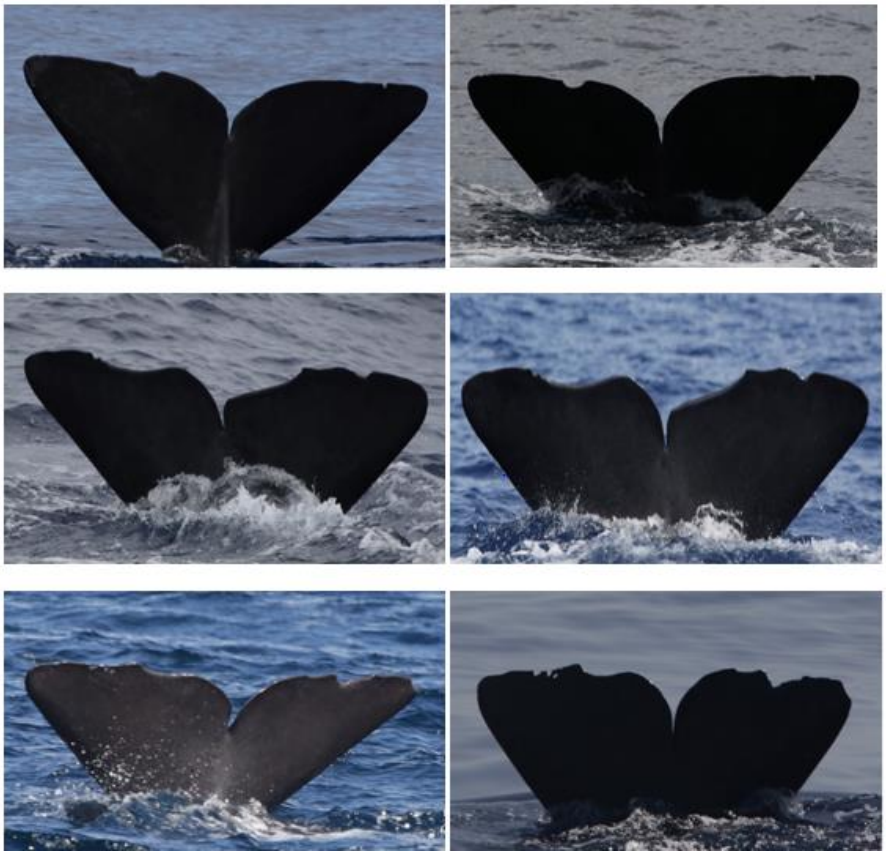

Figure 1: Sperm whale flukes photographed at the beginning of dives. The left and right sides correspond to matches between 2017 and 2018.

Photo-identification research has been developing through the advance of innovative techniques, such as the development of software which has automated the individual recognition process (Hammond et al., 1990). An example of these is the Europhlukes Phlex/Match programme that was designed specifically for the study of sperm whales and it was based on the methodology proposed by Huele et al. (2000).

Besides helping with local photo-identification studies, Europhlukes Phlex /March programme combined with international databases (such as the North Atlantic and Mediterranean Sperm Whale Catalogue) allows easier data exchange between research groups, facilitating international cooperation.

Another approach to identify sperm whale individuals are the mark-recapture techniques which are commonly used to estimate the abundance of animal populations and also the density based in the number of organisms present per unit area (Seber, 1982). This method basically consists of taking a sample from the population, counting and marking them. At the end, they are released back to their population. Subsequently, one or more further samples are taken and then the size of the population is calculated, from the number of marked and unmarked individuals present.

To make an effective mark-recapture experiment it has to be considered the accuracy that is required, the possible size of the population and the difficulty of marking live captures.

All the mark-recapture methods rest on this idea,

$$\frac{M}{N} = \frac{m}{n} \qquad N = \frac{Mn}{m}$$

N is the population size to be estimated.
M is the number of members of the population that are captured initially and tagged.
n is the number of members of the population that are captured subsequently.
m is the number of members of this subsequent captured population that are tagged.

and it allows to estimate life history parameters from photo-identification data of naturally marked individuals. It has been extensively used on several taxa, such as cetaceans (Hammond et al., 1990), manatees (Langtimm et al., 2004), sharks (Arzoumanian et al., 2005), and a variety of felids (Broekhuis and Gopalaswamy, 2016).

Many aspects of a population can be studied using photo-identification, including sperm whale behaviour, ecology and life history (Lettevall et al., 2002; Whitehead, 2003) and the application of mark – recapture analysis techniques may be used to investigate population size and life history parameters (Hammond, 1987; Whitehead, 2003).

2.4 The Azores and the Whale-Watching

The Azores is an archipelago composed of 9 volcanic islands and small islets that compose 3 distinct groups – eastern (Santa Maria and São Miguel islands), central (Terceira, São Jorge, Pico, Graciosa and Faial islands) and western (Flores and Corvo islands). The archipelago extends in a tectonic area along a WNW-ESE direction, between 37° and 40° N and 25° and 32° W in the Atlantic Ocean (Fig. 2) (Santos et al., 1995). Both location and the underwater topography of the Azores, with no continental platform and, therefore, great depths near the coast, make this archipelago a privileged site for the observation and study of cetacean species (Gordon et al., 1989; Santos et al., 1995).

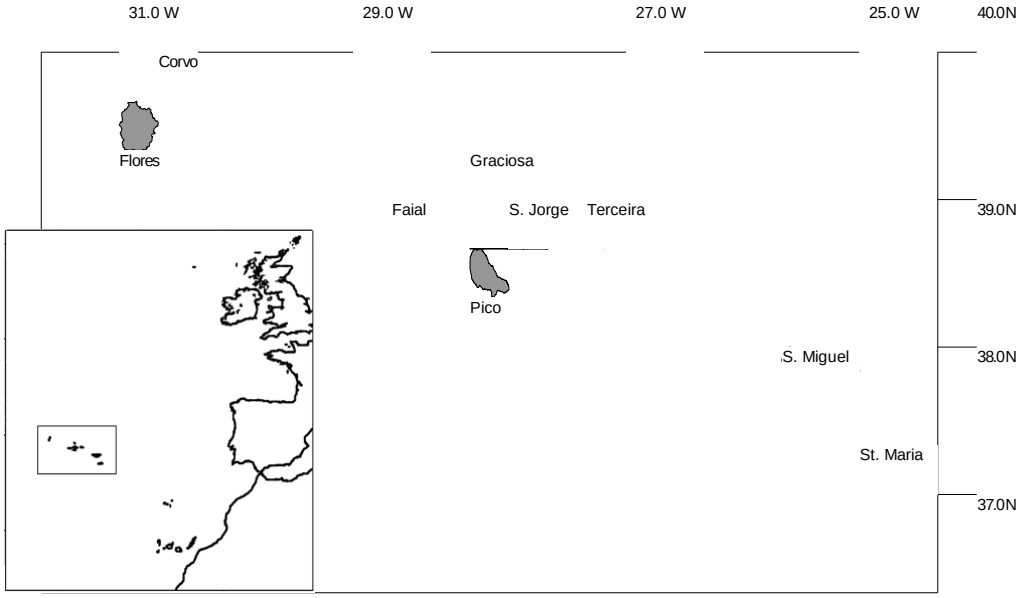

Figure 2: Azores Islands location.

In the Azores it is possible to find about 27 cetacean species, from 5 different families (Silva et al., 2014). The more frequently observed species in studies, performed with nautical census, are the spotted dolphins (*Stenella frontalis*), the common dolphin (*Delphinus delphis*), the bottlenose dolphin (*Tursiops truncatus*), the Risso's dolphin (*Grampus griseus*) and the sperm whale (*Physeter macrocephalus*) (Silva et al., 2014).

The Azores region is an important feeding, calving and, very likely, mating ground for sperm whales in the North Atlantic (Clarke, 1956; 1981). Females and males of all ages use the area year-round, but the majority of the observations is composed of social groups in late spring and summer (Silva et al., 2014). These social groups are nomadic (Whitehead et al., 2008), and the Azores contains only a part of their range. While a few groups appear to regularly use the area, there are no indications of residents (Silva et al., 2006, 2014).

Azorean whaling started in the second half of the XVIII century and it was influenced by the whaling ships that came from EUA, specifically from New Bedford and Nantucket. It was only in the end of the XIX century, that the Azorean whalers adapted the techniques that they have learned and initiated the coastal whale hunting in the region. The sperm whales were their main target, mostly due to their abundance around the islands. Then, several whale stations and factories started developing in different islands in the archipelago (Koehler, 2014).

Figure 3: Whale hunting on the Azores.

After the World War II and importation forbiddance, the Azorean whaling started to be reconsidered as a non-sustainable economic activity. In 1986, with the commercial whale hunting prohibition directive, the last whaling factory in the Azores was closed. A few years later, in 1992, the whale-watching activity started (Lance R et al., 1999). In addition to being a more conservationist activity, it also allowed and economical return from the observation of the animals that once were whaling target. Therefore, the Azorean people had the opportunity to apply their acquired knowledge during the whaling years, such as the use of lookouts ("vigias") and all their experience at sea (Koehler, 2014).

Nowadays, besides using lookouts to spot the animals and guide the vessels during their tours, the whale-watching companies also use hydrophones as a complementary method to locate sperm whales and delphinids (Oliveira *pers comm*). Currently, the whale-watching activity in the Azores is composed of 25 companies and 72 boats located on the islands of Santa Maria, São Miguel, Terceira, Pico and Faial (Governo dos Açores, 2019). In São Miguel the activity occurs during the whole year, with a highest peak in summer, but in the remaining islands there is a clear seasonality that starts in March-April and ends in September-October. In the same way as in São Miguel, the peak of the activity in these islands is also during the summer months (Oliveira, 2005; Oliveira et al., 2007). This activity is regulated with a regional decree ("Decreto Legislativo Regional nº 10/2003/A") that defines and regulates the different types of activity that target cetacean species and the permits for the whale-watching companies. Additionally, it also defines a code of conduct on the approach, number of boats, duration of observations and boat behaviour towards cetaceans in general, groups of delphinids or whales, and groups with calves.

2.5 Context of present work

The whale-watching activity may influence sperm whale behaviour, within short-term periods, by changing their respiratory interval, swimming speed and by triggering aerial displays (Magalhães et al. 2002). Possible long-term effects may have consequences on

their fitness, reproduction and resting behaviour, which are more difficult to investigate. The present work aims to evaluate the individual exposure of sperm whales to whale-watching vessels in the Azores, using the photo-identification as a tool. It is part of the Watch It project ("Whale watching effects on sperm whales – disturbance assessment towards a sustainable ecotourism" - ACORES-01-0145-FEDER-00057), developed by IMAR (Institute of Marine Research) – University of the Azores, where several tasks will be developed to assess the whale-watching effects on sperm whales in the Azores. Even though this work will not focus on the whole dataset that will be used in the referred project, it aims to contribute to better understand the individual exposure of this emblematic species to an increasing activity in the Azores archipelago.

3. MATERIAL AND METHODS

3.1 The study area

The Azores are centred at 38,8N and 28,8W, roughly in the middle of the North Atlantic along the Mid-Atlantic Ridge (Morton et al., 1998). The current dataset focus on photo-identification data collected by several whale-watching companies of two islands of the Azores, Faial and Pico, in 2017 and 2018, mostly in the area of the triangle Faial-Pico-São Jorge (Fig. 4).

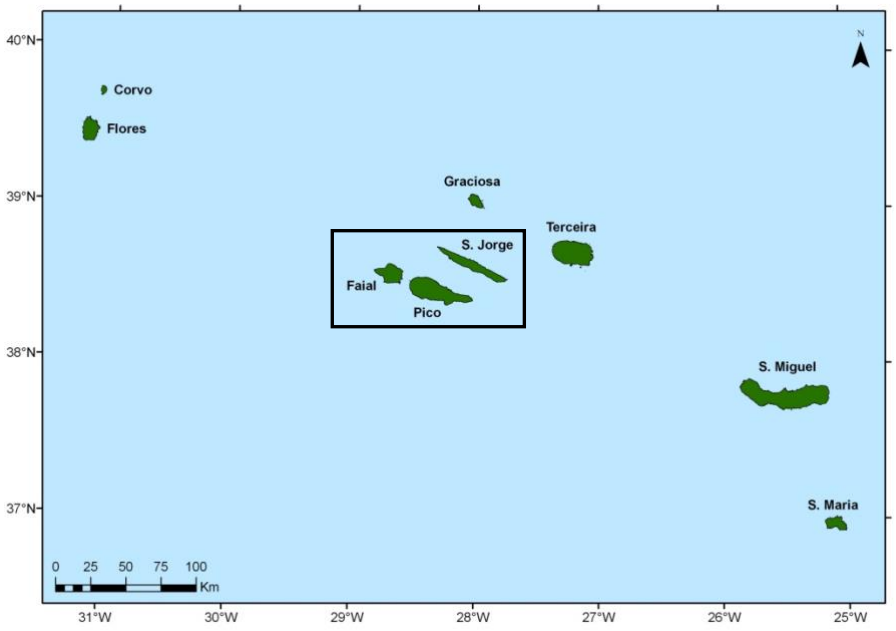

Figure 4: Study area. Azores triangle: Faial-Pico-Sao Jorge island (37°–41° N, 25°–31° W)

3.2 Data collection and analysis

In the scope of the Watch It project, the whale-watching companies from Faial and Pico provided information on sperm whale photos, sightings and vessel tracks during their whale-watching trips.

The referred photos were previously prepared by selecting the best picture within a sequence that preceded a dive (i.e. the best photo of a sperm whale fluke) and then by cropping it, to allow the fluke to become the major part of the picture.

Once the pictures were ready to be analyzed, the Phlex 1.3 programme was used to extract the contour of each fluke. The contours of the left and right lobes are extracted separately. To do that, it is necessary to choose a suitable zoom factor on the view panel and to select an extraction area that includes the start and end of the lobe (Figs. 5 and 6). Once the contour is automatically and/or manually done, it is necessary to save it with a confidence level (none, low, medium or high), which may provide some important information at the end of the analysis.

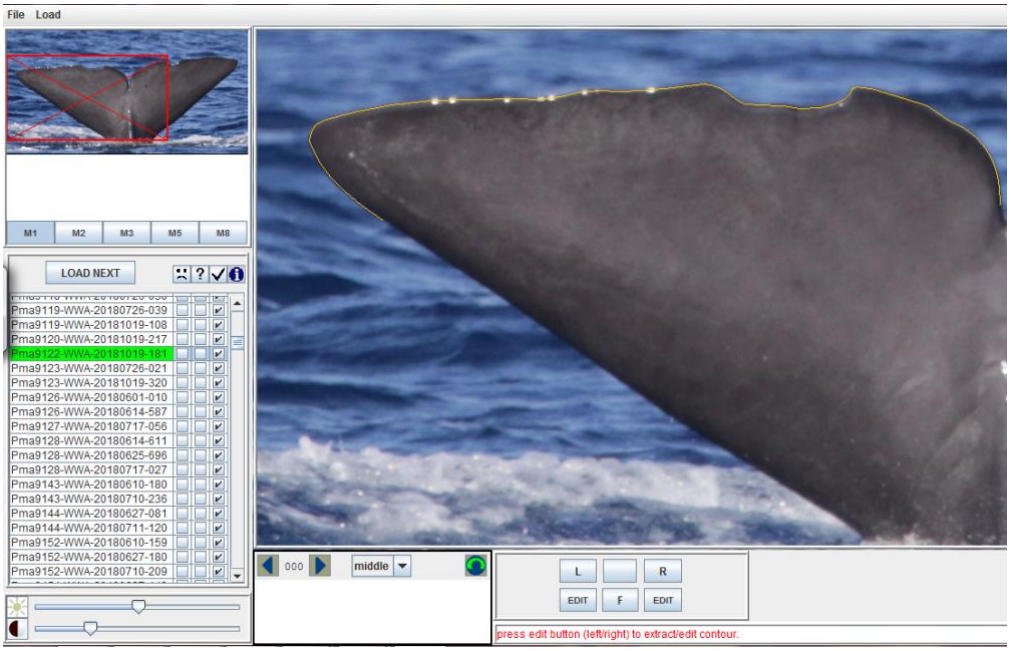

Figure 5: Example of contour extraction of the left lobe of a sperm whale fluke, in Phlex programme.

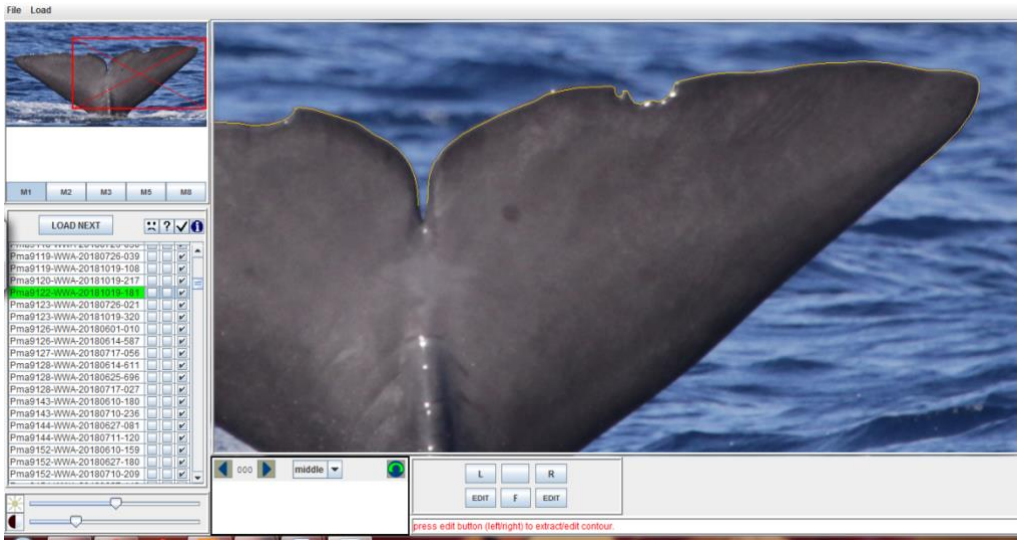

Figure 6: Example of contour extraction of the right lobe of a sperm whale fluke, in Phlex programme.

Subsequently, with Match 1.2 programme, it was performed the matching of sperm whale fluke contours. Once a picture (with an associated contour) was chosen, the programme compares it with all the other pictures (and associated contours) and ranks (0 to 1) the matching for each fluke lobe and also gives a general rank of both lobes (Fig. 7). In this programme, it is possible to compare visually both pictures and contours, in order to check all the comparisons that were made. Here, the visual checking of the referred comparisons was made until 0.5 of general ranking. Subsequently, according to the acceptance/rejection of the obtained matches, every time there was a new individual, it was renamed with a new number. In case of re-sighting, it was renamed with the number of the previous identification. For subsequent analysis, all the new and re-sighted individuals were included on an Excel sheet. Within this sheet, individuals were classified according to their degree of distinctiveness and picture quality (0-3 according to Arnbom (1987)). Following Hammond (1986), individuals with natural markings that were indistinct or that contained little information were not included as 'marked' animals and were discarded from the following analysis. Similarly, low quality pictures (e.g. pictures that were out-of-focus) were also discarded. The subsequent analysis was made by creating multiple graphics and tables about the number of identifications, resightings, temporal occurrence and geographic positioning of selected individuals with higher resighting values.

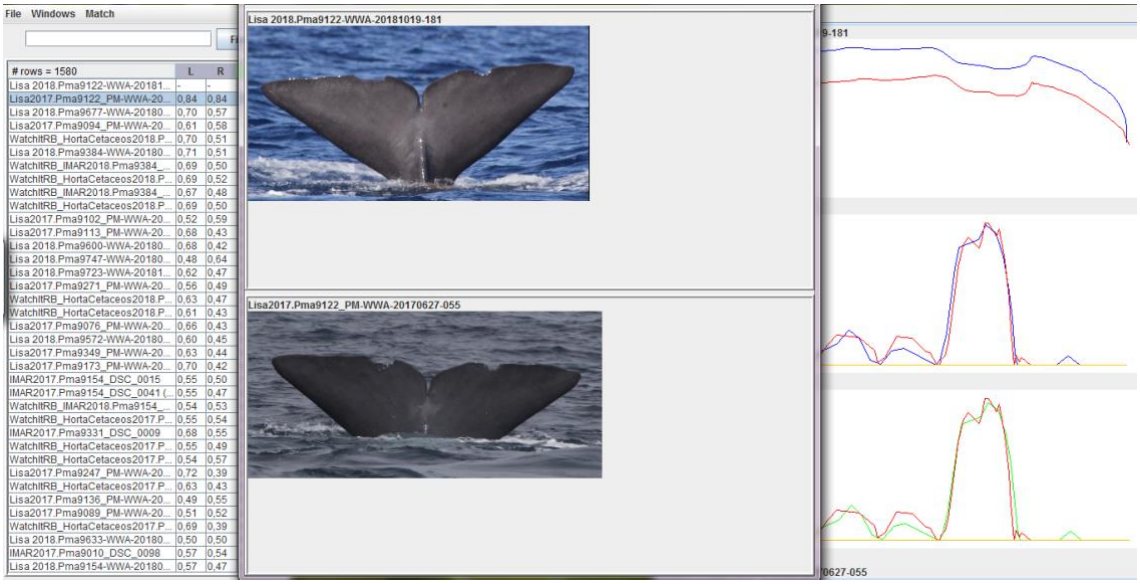

Figure 7: Example of matching between two photographs of the same sperm whale fluke, with comparison of photographs and contours, in Match programme.

As complementary material, a whale-watching intensity index that was calculated in the Watch It project (within other tasks of the project), was used to support the current results. This index was calculated by using geo-referenced information collected with the Automatic Identification System (AIS) of several whale-watching boats from Faial and Pico islands in 2018.

4. RESULTS

4.1 Sperm whale general photo-identification

From a total of 2603 pictures obtained from 5 companies that work in the triangle Faial-Pico-São Jorge, we used 2467 pictures and discarded 136 pictures (Tab. I), due to either bad quality of the picture (e.g. out of focus), because it captured only one lobe of the fluke, or by the absence of markings that would allow a later recognition (following Arnbom, 1987).

Table I – Number of obtained, used and analyzed pictures in 2017 and 2018 from the whale-watching companies that worked in the area Faial-Pico-São Jorge.

			No. Pictures	
Company	**Year**	**Total**	**Used**	**Discarded**
A	2017	375	353	22
A	2018	430	368	62
B	2017	597	597	0
B	2018	773	739	34
C	2017	26	25	1
D	2017	1	1	0
D	2018	11	11	0
E	2017	90	85	5
E	2018	300	288	12
Total		2603	2467	136

The data that was used was collected from March 2017 to November 2017 as well as from March 2018 to October 2018 (Fig. 8). The number of new individuals increases mostly in June and July 2017 and in July and August 2018. The number of resightings increases mostly in July and August 2017 and June and August 2018 (Fig. 8). The total number of individuals is highest during the summer's months. During the sampling period, the total number of distinct individual identifications was 750 (Fig. 9). From all these 750 animals, a great majority was only observed once (78%), then 10% of those were observed twice and only one sperm whale was observed in 14 different days, along both years (Fig. 10).

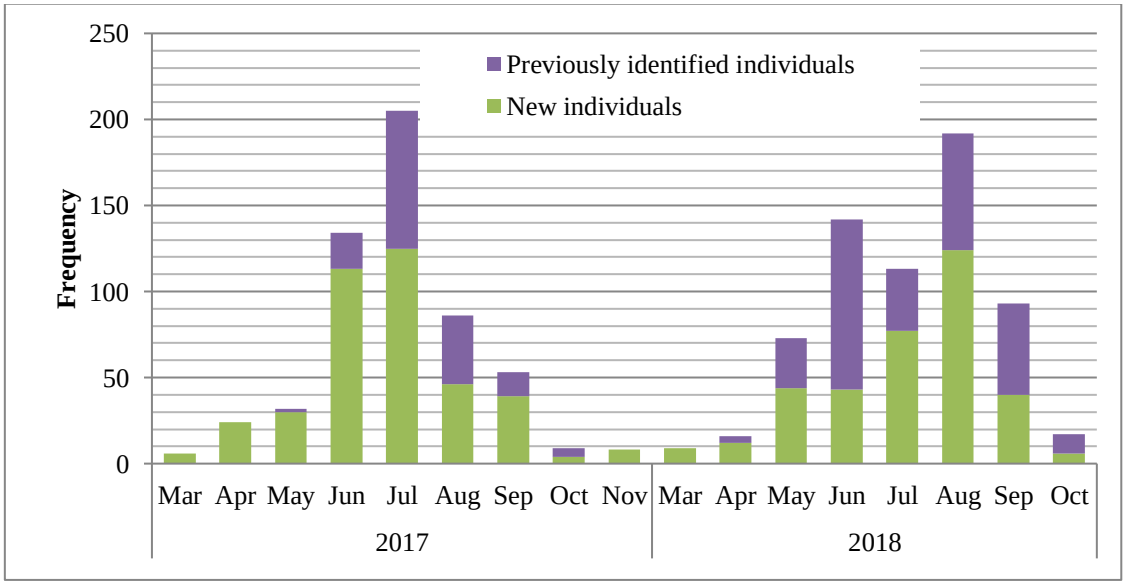

Figure 8: Frequency of new and resighted individuals per month in 2017 and 2018.

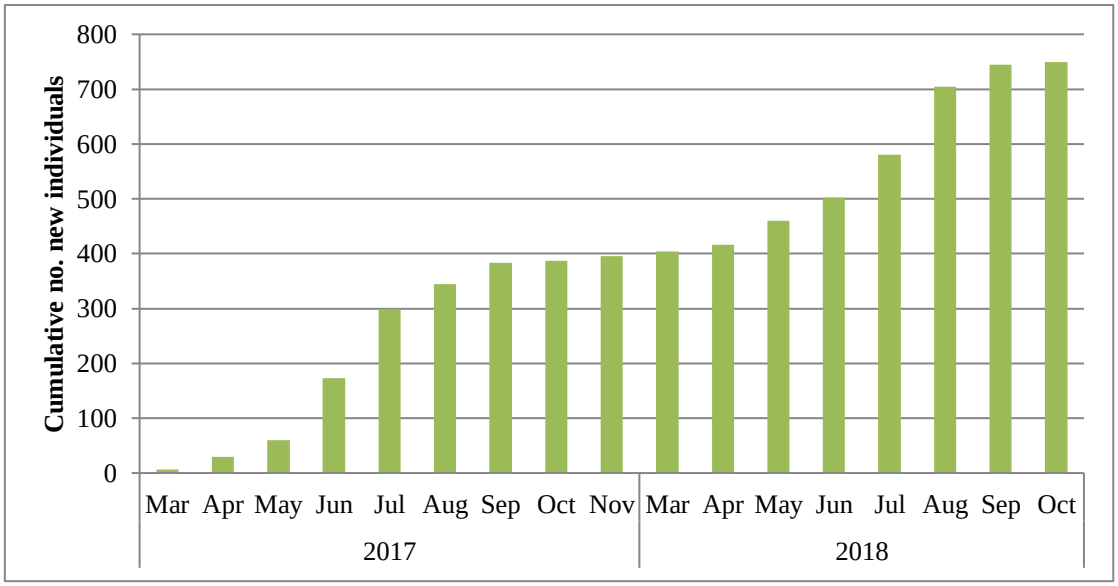

Figure 9: Cumulative number of new individuals per month in 2017 and 2018.

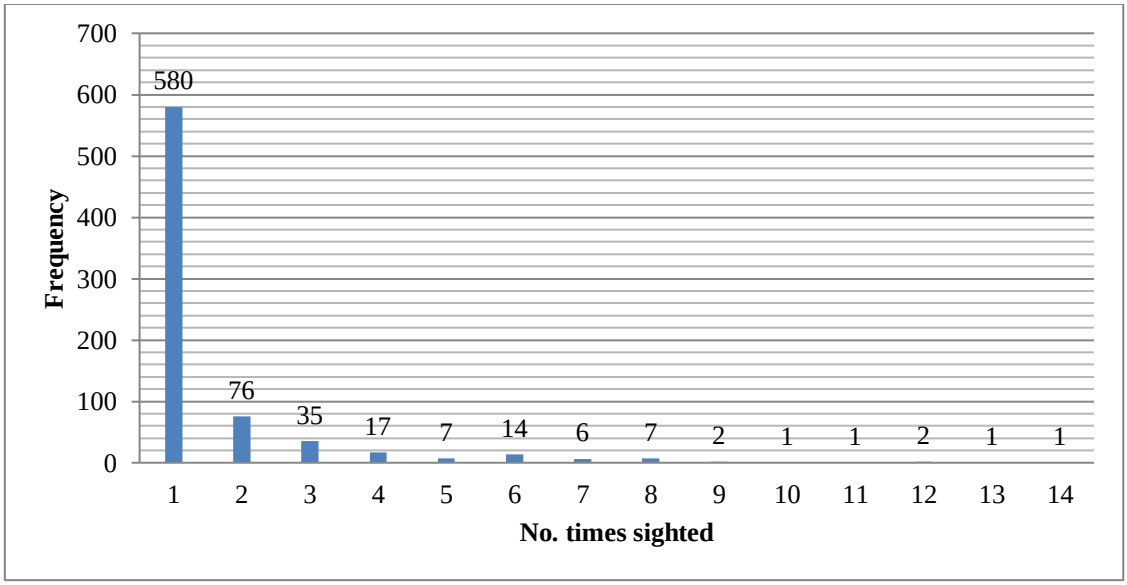

Figure 10: Frequency of individuals that were sighted a determined number of days, along both years (2017 and 2018).

Taking into consideration the 170 resighted individuals (2-14 times along both years), the consecutive sightings along the same year occur mostly with 1-3 weeks interval, with just a few animals being resighted with an interval of 10 weeks or more (Fig. 11). From these 170 individuals, 76 (45%) were (re)sighted in both years and the remaining individuals (55%) were resighted within only one year.

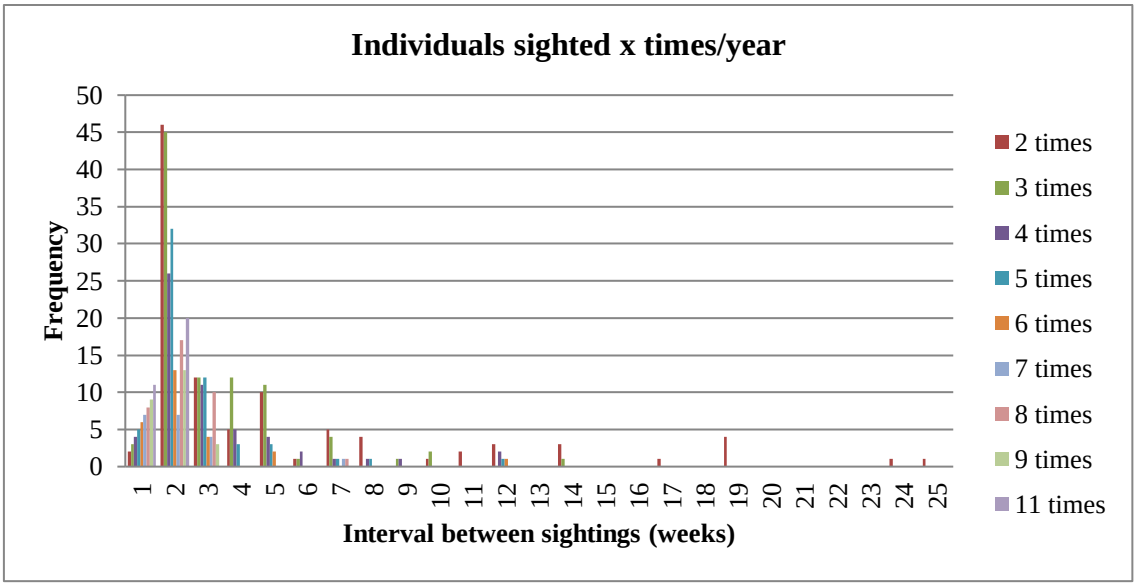

Figure 11: Frequency of individuals that were resighted from 1 to 25 weeks interval, in animals resighted twice to 11 times in the same year (2017 or 2018).

4.2 Sperm whale individual exposure to whale-watching

The GPS (Global Positioning System) locations of the 6 individuals that were resighted more times along both years (Figs. 12 and 13), indicate that the southern part of Faial and Pico islands have the majority of these resightings. In 2017, the interval of days between the first and last sightings of each individual (in brackets – Fig.12) ranged from 37 to 41 days for Pma9027, Pma9025 and Pma9245. However, for Pma9152 and Pma9154 the interval was 80 and 82 days, respectively. For 2018, the interval of days between first and last sightings ranged from 22 to 33 days (Fig. 13). Moreover, several days when Pma9025 was resighted coincided with the ones of Pma9027, pointing to a possible group relation. Pma9152 and Pma9154 seem to be part of another group, as they exhibit a similar resighting behaviour.

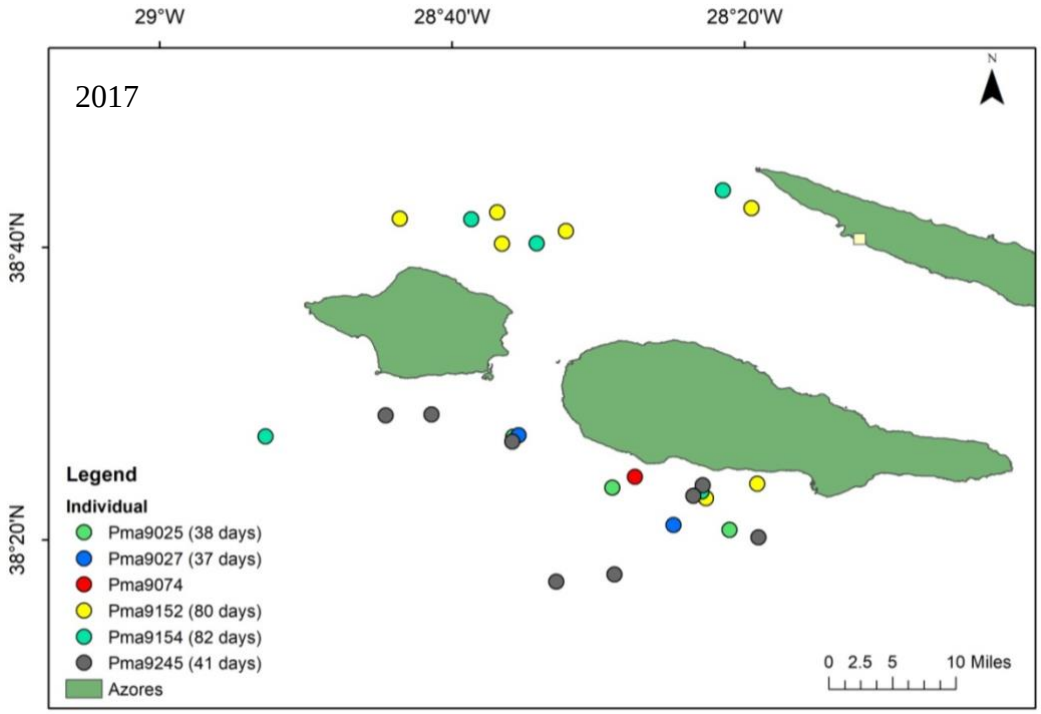

Figure 12: Positions of the 6 individuals that were more frequently sighted in 2017. The number of days in brackets refers to the interval between the first and last sighting.

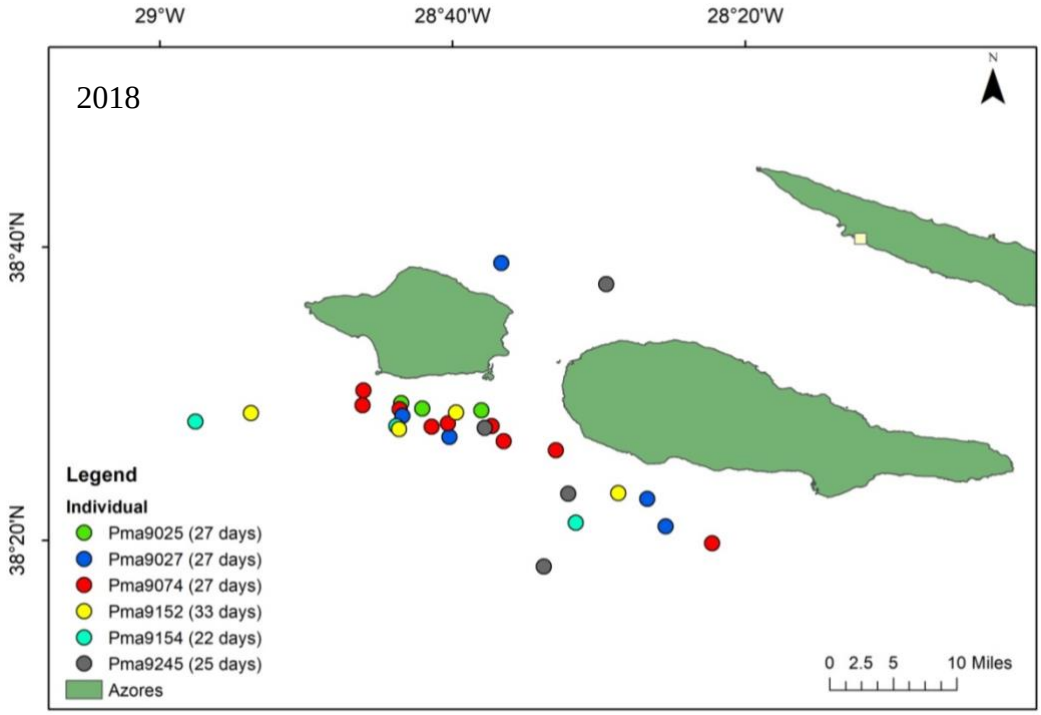

Figure 13: Positions of the 6 individuals that were more frequently sighted in 2017. The number of days in brackets refers to the interval between the first and last sighting.

Using the whale-watching intensity index with the positions of the 6 individuals that were more frequently sighted in both years (2017 and 2018), it is possible to visually verify that, in general, these sperm whales were observed in the highest whale-watching intensity area (Fig.14). Moreover, for the referred sperm whales, it is possible to obtain

an individual whale-watching intensity value (Tab. II). In 2017, the individuals that had higher intensity values (Pma9025, Pma9027, Pma9074 and Pma9245) were also the ones that were only observed mostly in the southern part of the islands (Fig. 12). In 2018, there seems to be no clear relation between the whale-watching intensity and the position of the sightings, either northern or southern parts of the islands.

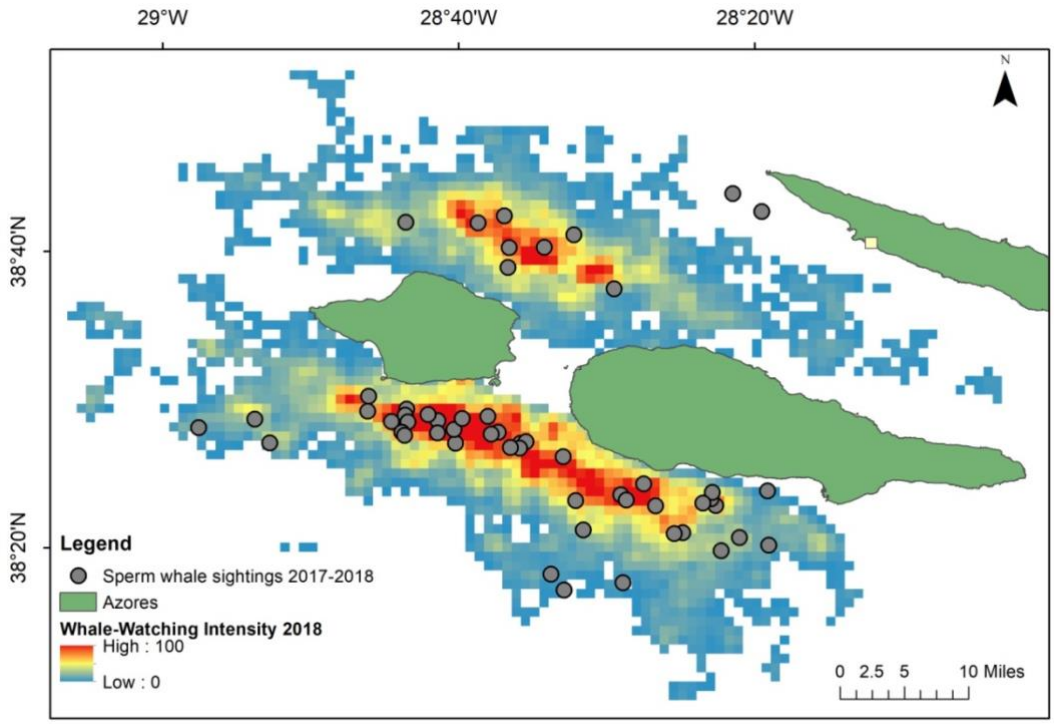

Figure 14: Whale-watching intensity index obtained through AIS positioning system from several whale-watching boats (Faial and Pico), and the positions of the 6 individuals that were more frequently sighted in both years (2017 and 2018).

Table II – Whale-watching intensity index mean and standard deviation, for the 6 individuals that were more frequently sighted in both years (2017 and 2018).

	2017				2018			
	Mean	**Std**	**Min**	**Max**	**Mean**	**Std**	**Min**	**Max**
Pma9025	31,77	14,45	15,64	43,51	43,46	20,28	15,43	84,23
Pma9027	33,93	11,35	25,90	41,96	39,40	19,01	15,43	71,04
Pma9074	33,71	0,00	33,71	33,71	42,97	20,15	15,43	76,00
Pma9152	21,67	14,28	0,33	35,66	34,22	20,44	15,20	64,66
Pma9154	18,17	23,95	0,33	49,60	17,34	12,74	5,80	31,01
Pma9245	33,38	33,34	0,67	100,00	26,12	25,48	3,23	27,70

5. DISCUSSION

5.1 Sperm whale general photo-identification

In our study, the full dataset consisted of 2467 high-quality pictures of 750 individuals collected in the period of March-November 2017 and March-October 2018. From these, 78% were only sighted once within the two years (Fig.10). A similar result (76% of individuals only seen once, i.e., transients, according to Pradel (1997)) was also obtained in a previous sperm whale abundance study that was developed in the same area of Faial-Pico-São Jorge islands (Boys et al., 2019). This suggests that, besides comprising only 2 years of data and not from all whale-watching companies of the study area, the current dataset seems to reflect the tendency of a much bigger set of data (1987-2015) previously analyzed (Boys et al., 2019). However, this high percentage of transients may be overestimated by not being able to recapture some of the individuals. This may be due to: i) working in a distinct area of the one of the individuals, ii) the absence of photo-identification collection from a part of whale-watching companies, or iii) the timing of photo-identification data supply from the whale-watching companies that was not coincident with the course of this work.

In relation to the number of new individuals and resightings, the majority of them (76% in 2017 and 68% in 2018) were observed during the summer months (June, July and August; Fig. 8). This could indicate a higher number of individuals during this period, but it is much more likely due to the seasonality of the activity in the islands of Faial and Pico. A higher effort from the whale-watching companies during the summer months (Oliveira et al., 2007), performing 2-3 daily trips traduces into a higher photo-identification sampling which is reflected in a higher number of individual identifications.

5.2 Sperm whale individual exposure to whale-watching

In the present study, 76 sperm whales were (re)sighted in both years, indicating that about 45% of the whales that were seen more than once (from a total 170 individuals), seems to visit the study area repeatedly. According to Silva et al. (2006, 2014) and Boys et al. (2019), the sperm whale population, in this study area, exhibits short residence periods, with an even-flow of animals entering the area in consecutive years.

The majority of sperm whales that were resighted, in the same year, were observed within intervals of 1-3 weeks (Fig. 11). During these weeks they may be a target for the whale-watching companies. According to Steiner et al. (2015) several individuals were resighted between the Azorean islands, even within the same year, which corroborates the idea that they leave and return to the study area, performing movements between the islands (Figs. 11, 12 and 13).

Although the present results are limited (only two years of data and not from all whale-watching companies), it is important to highlight that the resighting of different individuals in multiple common days suggest that these individuals belong to groups/family units. As sperm whales seem to be observed repeatedly over the years (Magalhães et al. 2005), these family unit members may be the ones with highest vulnerability to the whale-watching presence.

The majority of sightings of the 6 more frequently observed individuals occurred within the highest whale-watching intensity area (Fig. 14). Although the whale-watching intensity index was calculated with data from 2018, we assume that the obtained estimates may also be representative of the 2017 season, as the number of companies and boats did not change within both years. Following this assumption, the individual whale-watching intensity values for 2017 suggest that there might have been less whale-watching intensity in the northern part of the islands (Fig. 12; Tab II). This hypothesis may be validated in the future, with the collection of GPS tracking of the whale-watching companies from 2017.

Furthermore, the AIS data used here does not contain information from all the whale-watching boats in the study area and, until now, it doesn't have tracking data (AIS or GPS) from boats of the south of Pico. This may explain the low whale-watching intensity values for the majority of south of Pico area (Fig. 14). Therefore, with a better track sampling (AIS or GPS), the whale-watching intensity on these 6 sperm whales and possibly other ones will be, very likely, higher in the southern part of Pico island.

According to Oliveira et al. (2007), in 2004 there were 15 whale-watching companies, with 35 boats. Nowadays, there are 25 whale-watching companies and 72 boats in the whole archipelago (Governo dos Açores, 2019). Clearly, this activity has increased substantially in these past 15 years and, in the study area, there are 10 whale-watching companies and 23 boats (Governo dos Açores, 2019). The Watch It project aims to investigate the effects of the whale-watching activity on sperm whales and currently is focusing on this study area (Faial-Pico-São Jorge islands). Assuming the whale-watching industry will continue increasing in the remaining islands of the archipelago (the maximum number of licenses has already been reached in the study area, according to the DLR 10/2003/A), it is essential to develop efforts to study the long-term effects, such as changes on their fitness. Thus, studying sperm whale individual exposure to the whale-watching vessels is of major importance.

6. CONCLUSIONS

The aim of this work was to study the individual exposure of sperm whales to whale-watching boats in the area Faial-Pico-São Jorge. The majority of sperm whales observed in the study area, only contact with whale-watching vessels once, so the possible effect on them should be minimal. The remaining whales, the ones that are resighted, seem to exhibit a temporary emigrant behaviour from the study area. Although these animals

only represent 22% of the identified individuals, they seem to be visiting the area multiple times within a year and, apparently, repeatedly in several years. Therefore, these individuals seem to be the ones that may be under higher whale-watching pressure possibly affecting them on their fitness, reproductive behaviour, nursing, care of the young and survival. Thus, it is of major importance to investigate further the effects of this activity on these groups of animals, either following short-term (Magalhães et al., 2002; Visser et al., 2010) or long-term evaluation methodologies.

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Descripción detallada de las actividades desarrolladas durante la realización del TFT

En este apartado se expondrán y comentarán todos los conceptos relacionados con la realización del TFT. Se explicará brevemente el proceso de cada actividad realizada, así como la formación recibida y el nivel de integración e implicación dentro del departamento y relaciones con el personal.

Área de estudio

El área de estudio se centra principalmente en las islas de Faial, Pico y Sao Jorge, situadas en el archipiélago de las islas Azores a 38,8N y 28,8W del océano Atlántico. Se trata de una zona de paso de cetáceos muy importante, en la que durante todos estos años de estudio y de recopilación de información, se han llegado a identificar hasta 16 especies diferentes de ballenas e 11 de delfines.

Recopilación de datos bibliográficos

Durante estos meses de trabajo se ha ido recopilando información relacionada con los cachalotes, a través de libros, revistas, publicaciones del equipo, etc, con el fin de interiorizar y conocer bien dicha área y así poder obtener un alto rendimiento de trabajo, aprovechando al máximo la oportunidad de trabajar en el ámbito científico con personas reconocidas y con tal experiencia

Análisis de fotos

La recopilación de datos, a través de la colaboración de varias empresas de whale-watching de la zona, nos permitió realizar un análisis completo, a través de los programas Phlex y Match, los cuales fueron desarrollados por la IFAW (International Fund for Animal Welfare), en el ámbito del proyecto Europhlukes. Se trabajó en ello durante varios meses con perseverancia y esfuerzo, para la obtención de resultados claros que permitiesen llegar a conclusiones sin errores.

Formación recibida

Durante la realización del TFT la formación recibida se basó principalmente en las técnicas y metodologías más apropiadas para la foto identificación de cetáceos marinos. Me dieron las herramientas para poder trabajar en ello, con los programas informáticos comentados anteriormente. También recibí conocimientos básicos sobre el tratamiento de muestras de tejidos en laboratorio y sobre análisis de datos georreferenciados con un programa de sistema de información geográfica (ArcGIS).

Nivel de integración e implicación dentro del departamento y relaciones con el personal

El nivel de integración e implicación dentro del departamento ha sido muy bueno. Me han facilitado mucho el trabajo con su disponibilidad a la hora de ayudarme y

explicarme cualquier duda que pudiera surgirme. Además de querer enseñarme con entusiasmo sus diferentes áreas de trabajo. He tenido la oportunidad de trabajar en un idioma diferente al mío, en este caso el portugués, lo cual me ha permitido perfeccionarlo dentro del ámbito científico y abierto muchas oportunidades para continuar en el estudio del mundo marino.

Aspectos positivos y negativos más significativos relacionados con el desarrollo del TFT

En general han sido todo aspectos positivos, tanto el aprendizaje como el desarrollo del trabajo y finalmente el plasmarlo en el informe. Han sido etapas diferentes, pero todas positivas. Cada una con sus dificultades, pero a base de esfuerzo se han alcanzado las metas propuestas.

Valoración personal del aprendizaje conseguido a lo largo del TFT

El aprendizaje adquirido durante todo este tiempo de trabajo ha sido tanto personal como profesional. He conseguido realizar técnicas que desconocía por completo, las cuales me han conducido hasta el mundo de la foto identificación, en el que muchas personas y lugares interesantes están involucrados. Con todo ello, se me han abierto otras posibilidades, y muchas ganas de seguir aprendiendo. Por tanto, puedo decir que la experiencia de realización de este trabajo ha sido de 10.