EXPEDITION REPORT

Expedition dates: 20 March – 20 April 2023

Report published: March 2024

Photo-identification and surveys of cetaceans in the central group of the Azores islands

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Matthias Hammer (editor)
Biosphere Expeditions

Abstract

In 2023 Biosphere Expeditions concluded its 17th year of cetacean photo-identification and distribution studies in the Azores. The expedition was based in Horta on the island of Faial and work was conducted around the three islands of Faial, Pico and São Jorge. The expedition ran from 20 March to 20 April 2023. 172 sightings of ten different species of cetacean and eight loggerhead turtles were recorded during the expedition period.

Baleen whale photo-ID
Blue Whale: The expedition recorded six blue whales in four encounters. Photos of individuals were shared with catalogues in Spain, Iceland and Canada. One blue whale matched to Pico, 2009, another to Pico, 2008. There were no international matches. Matches were made by Richard Sears of Mingan Island Cetacean Society. *Fin whale***:** Three fin whales were recorded in two encounters. Identification photos were shared with catalogues in Spain, Iceland & Canada. No matches were found. *Sei whale:* Fourteen sei whales were recorded in eight encounters. There is no coordinated sei whale catalogue to share ID photos with, so photos were shared with sei whale researchers. *Humpback whale:* Three humpback whales were recorded during the expedition in seven encounters. One whale was seen four times on three different days. Another whale was seen twice on the same day. No international matches were found. The North Atlantic Humpback Whale Catalogue currently holds over 11,000 individuals and plays an important role in discovering long-range matches. Since 2004 the expedition has contributed 28 ID photos, helping to elucidate movements of the eastern Atlantic humpback whales, about which little is known. *Summary:* While still not as abundant as in previous years (2014-2017), more baleen whales were seen during the 2023 expedition than in 2022. There were further blue, fin, sei and humpback whales seen after the expedition. It is thought that this is connected to chlorophyll density in the water and therefore food availability.

Sperm whale photo-ID
Sperm whales were seen multiple times during the expedition. Sperm whale photo-identification, ongoing since 1987 in the Azores, continued. Forty-six identifiable individuals were photographed from 87 encounters, including 16 animals seen in previous years in the Azores, 27 new individuals and three flukes that were unidentifiable. There were no long-range matches. Photo-ID now indicates that most of the males we observe migrate to Norway and that females spend their whole lives together, and undertake at least a limited migration. In addition, sperm whale groups observed in the Azores are more stable and associations between individuals last for a much longer period of time than they do in the Pacific. This is most likely due to food availability in the different oceans.

Dolphins
Dolphin photo-identification, which began in 1987, also continued. Two of our main dolphin photo-ID target species were encountered: Two groups of Risso's dolphin and ten groups of bottlenose dolphin were recorded. In addition, a group of false killer whales, which are encountered rarely, was observed. Both the bottlenose and Risso's dolphin groups had some known individuals from resident groups. The false killer whale group also had several known individuals. Common and striped dolphin were also recorded, although they not photographed as they are not target species for photo-identification.

Europhlukes & Happywhale
Sperm whale fluke shape extractions were made from the photos taken during the expedition and compared with those of sperm whales sighted in previous years and in other areas of the Atlantic. No matches were found to any other regions.

POPA
Data for the Department of Oceanography and Fisheries (DOP) of the University of the Azores, for the Tuna Boat Observer programme, POPA, was successfully collected for an 18th year. The expedition vessel "Physeter" is the only non-fishing vessel in the programme. Information was collected for random cetacean sightings along transects, as well as designated turtle and bird count attempts and marine debris sightings.

Turtles
Loggerhead turtle data have been collected and animals tagged in the Azores since 1988 for a joint venture between the University of Florida and the University of the Azores. During this expedition eight loggerhead turtles were seen, but none were caught and tagged due to weather conditions, other research priorities or the turtles diving.

Resumo

Em 2023, a Biosphere Expeditions, concluiu o seu 17º ano de recolha de dados sobre a distribuição de cetáceos nos Açores. A cidade da Horta, na ilha do Faial, foi a base da expedição e o trabalho foi conduzido em redor das ilhas do Faial, Pico e São Jorge. Esta expedição decorreu entre 20 de Março e 20 de Abril de 2023. Foram registados 172 avistamentos de 10 espécies diferentes de cetáceos e 8 tartarugas-careta durante o período da expedição.

Baleias de barbas photo-ID: *Baleia-azul:* A expedição registou oito baleias-azuis em quatro encontros. Fotos dos indivíduos foram partilhadas com catálogos em Espanha, Islândia e Canadá. Uma baleia-azul foi identificada como sendo do Pico, 2009, outra do Pico, 2008. Não houve correspondências internacionais. As identificações foram feitas por Richard Sears da Sociedade Cetácea da Ilha Mingan. *Baleia comum:* Três baleias comuns foram registadas em dois encontros. Fotos da identificação foram partilhadas com catálogos em Espanha, Islândia e Canadá. Não foram encontradas correspondências. *Sardinheiras:* Catorze sardinheiras foram registadas em oito encontros. Não existe um catálogo coordenado de baleias-sardinheiras para partilhar fotos de identificação, por isso as fotos foram partilhadas com investigadores de sardinheiras. *Baleia-de-bossa:* Três baleias-de-bossa foram registadas durante a expedição em sete encontros. Uma baleia foi vista quatro vezes em três dias diferentes. Outra baleia foi vista duas vezes no mesmo dia. Não foram encontradas correspondências internacionais. O Catálogo de Baleias-de-bossa do Atlântico Norte atualmente possui mais de 11.000 indivíduos e desempenha um papel importante na descoberta de correspondências a longa distância. Desde 2004, a expedição contribuiu com 28 fotos de identificação, ajudando a esclarecer os movimentos das baleias-de-bossa no leste do Atlântico, sobre as quais pouco se sabe. *Resumo:* Embora ainda não tão abundantes como em anos anteriores (2014-2017), foram avistadas mais baleias de barbas durante a expedição de 2023 do que em 2022. Houve mais avistamentos de baleias-azuis, de baleias comuns, de sardinheiras e de bossa após a expedição. Acredita-se que isso esteja relacionado com a densidade de clorofila na água e, portanto, a disponibilidade de comida.

Cachalote: Cachalotes foram vistos várias vezes durante a expedição. Desde 1987 que está em curso nos Açores um programa de foto-identificação de cachalotes. Foram fotografados 46 indivíduos identificáveis em 87 encontros, incluindo reavistamentos de 16 animais vistos em anos anteriores e 27 novos animais. Não houve correspondências de longo alcance. As reavistamentos detectados agora indicam que a maioria dos machos que observamos migra para as águas da Noruega e as fêmeas passam a vida em grupos e efectuam migração/movimentações mais limitadas. Para além disso, os grupos de cachalotes observados nos Açores são mais estáveis e as associações entre indivíduos permanecem por períodos mais longos do que as que ocorrem no Pacífico. Este facto deve-se, provavelmente, à diferença de disponibilidade de alimento entre ambas as áreas.

Golfinhos: A foto-identificação de golfinhos, que se iniciou em 1987, tem continuado. Duas das nossas principais espécies-alvo de identificação de golfinhos foram encontradas: foram registados 2 grupos de grampos e 10 grupos de roaz. Além disso, tínhamos um grupo de falsas orcas, que não são encontradas com tanta frequência. Embora os roaz e os grampos sejam grupos conhecidos. O grupo de falsas orcas também tinha alguns indivíduos conhecidos. Golfinhos comuns e riscados também foram avistados, mas eles não fazem parte da foto-identificação.

Europhlukes & Happywhale: As extrações da forma da cauda de cachalote foram feitas a partir das fotografias tiradas durante a expedição e comparadas com as de cachalotes avistados em anos anteriores e em outras áreas do Atlântico. Nenhum dos cachalotes fotografados nos Açores foi reavistado noutras áreas.

POPA: Pelo 18º ano foram recolhidos dados para o Programa de Observação das Pescas nos Açores (POPA) coordenado pelo Centro do Instituto do Mar da Universidade dos Açores. O "Physeter" é a única embarcação que não se dedica à pesca comercial e que contribui para o POPA. A informação foi recolhida aleatoriamente ao longo de trajetos de observação de cetáceos. Foram também efetuadas tentativas de contagem de tartarugas, aves marinhas e avistamentos de lixo marinho.

Tartarugas: As tartarugas Caretta caretta são capturadas e marcadas nos Açores desde 1988, para um projecto conjunto entre a Universidade da Flórida e a Universidade dos Açores. Durante esta expedição, 8 tartarugas-boba foram avistadas, mas nenhuma foi capturada ou marcada devido às condições meteorológicas, outras prioridades ou mergulho das mesmas.

Contents

1. Expedition review

M. Hammer (editor)
Biosphere Expeditions

1.1. Background

Background information, location conditions and the research area are as per Steiner & Hammer (2020). This particular report deals with the expedition that ran from 20 March to 20 April 2023. The expedition was part of a long-term research project to elucidate the life histories and migration patterns of whales, dolphins and turtles across the oceans and assist with the formulation of effective conservation strategies.

1.2. Dates & team

The project ran over a period of one month divided into three 10-day groups, each composed of a team of national and international citizen scientists, professional scientists and an expedition leader. Group dates were as shown in the team list below. Dates were chosen to coincide with the migration of baleen whales past the archipelago.

The expedition scientist and co-author of this report was Lisa Steiner, the expedition leader was Craig Turner. The expedition team of citizen scientists was recruited by Biosphere Expeditions and consisted of a mixture of ages, nationalities and backgrounds. They were (in alphabetical order and with country of residence):

20 – 29 March 2023

Wendy Astill (UK), Valen Dawson (USA, press), Elena Felsberger (Austria), Alice Ford (USA, press), Andrea Jahrhaus (Germany), Emma-Jayne Lockwood (UK), Tracy Lube (USA), Kerstin Mitza (Germany), Sofia Quaresma de Oliveira (Portugal, placement), Peter Thoem (Canada).

31 March – 9 April 2023

Anna-Theresa Arnold (Germany), Gernot Bours (Germany), Jenny Casna (Germany), Nina Fair (USA), Cord Moeller (Netherlands), Renate Schulenberg (Netherlands), Bendine Schwob (Germany), Jo Seetoh (Singapore), Teri Siskind (USA), Monika Wernerus (Germany).

11 – 20 April 2023

Claudia Bohnsack (Germany), Joel Hoß (Germany), Edward Jenks (UK), Dan Knopp (USA), Eva Kohl (Germany), Emilia Mussoni (Germany), Stefanie Parchmann (Germany), Thomas Quilitz (Germany), Valerie Rice (USA).

A medical umbrella, safety and evacuation procedures were in place, but did not have to be invoked as there were no health or safety incidences.

1.3. Partners

The expedition's main partner is Whale Watch Azores, a whale watching and research group founded by our local scientists and operating from Faial Island. Other partners include Europhlukes (a European cetacean photo-ID system and research database), the University of the Azores, POPA (the Observer Programme for the Fisheries of the Azores), the University of Florida (for research into turtles), as well as the local community of whale spotters (vigias).

1.4. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. Without our citizen scientists (listed above) who provided an expedition contribution and gave up their spare time to work as research assistants, none of this would have been possible. The support team and staff (also mentioned above) were central to making it all work on the ground. Thank you to all of you and the ones we have not managed to mention by name (you know who you are) for making it all happen. Biosphere Expeditions would also like to thank the Friends of Biosphere Expeditions for their sponsorship and/or in-kind support.

We would also like to thank our partners Europhlukes, the University of the Azores, POPA, and the local community of whale spotters (vigias). A final thanks goes to skipper Siso as well as James Rosa and Claudia Steube, our excellent hosts at Banana Manor.

1.5. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and more can be found on the Biosphere Expeditions website www.biosphere-expeditions.org. Enquires should be addressed to Biosphere Expeditions at the address given on the website.

A copy of this and all other reports and scientific publications produced by or in association with this expedition can be found on the Biosphere Expeditions ResearchGate page.

A copy of the diary of this expedition is on the Biosphere Expeditions blog page.

1.6. Expedition budget

Each citizen scientist paid towards expedition costs a contribution of €1,980 per person. The contribution covered accommodation and meals, supervision and induction, special non-personal equipment, and all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses such as telephone bills, souvenirs etc., or visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	€
Expedition contributions	55,484
Expenditure	
Base camp and food includes all board & lodging, base camp equipment	9,687
Research vessel & transport includes fuel, oils, wear & tear for research vessel, taxis on land	8,725
Equipment and hardware includes research materials & gear, etc.	2,080
Staff includes local and Biosphere Expeditions staff & expenses	10,418
Administration includes registration fees, sundries, etc.	101
Team recruitment Azores as estimated % of PR costs for Biosphere Expeditions	7,334
Income – Expenditure	**17,139**
Total percentage spent directly on project	**69%**

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

2. Whale & dolphin study

Lisa Steiner*
Whale Watch Azores

2.1. Introduction

The Azores are a group of nine islands located about 900 nautical miles off the coast of Portugal. 28 species of cetacean have been seen in the islands over the last 30 years. Sperm whales were commercially hunted there until 1985. With the cessation of whaling, whale watching was a natural successor, but did not begin in earnest until the late 1990s. Little research work has been done around the archipelago before May, which is why the expedition usually takes place in March and April. In 2023, the expedition began on 20 March.

Baleen whales have been seen fairly regularly migrating past the islands from February to the end of May over the last twenty years, but it is unknown exactly where they have come from or where they are migrating to. It is thought that most are travelling north to feed in the waters around Iceland, Greenland, Norway or even Canada for the summer. Conversely, in the very early part of the spring, February, March and early April, humpbacks may be heading south to the breeding areas (Fredrik Broms pers. comm.). Photo-identification of the animals passing the Azores enables us to match photos taken in the Azores with photos taken elsewhere to hopefully determine some of these migration routes. So far, there have been matches of blue whales between the Azores to feeding grounds to the north: several have matched to Spitzbergen, Norway. There are two matches to Iceland and probably the most interesting match to date is from 2014: a blue whale that had been seen in the Gulf of St. Lawrence, Canada in 1984 was seen off the South coast of Pico, 30 years later. There are now additional matches to Northern Spain and Ireland. In addition, several blue whales have now been seen in multiple years in the Azores (Richard Sears pers. comm.). Thirteen humpback whales have been observed in both the Azores and the Cape Verde Islands and 11 have also been re-sighted in Norway. Two individuals have been seen in all three places. There are also 5 matches to Guadalupe. In 2018, outside the expedition, a humpback previously seen in Scotland was photographed in the Azores. Two humpback matches have been made to Newfoundland, also not by the expedition.

Although sperm whales were caught during whaling in the Azores all year round, it has been thought that there are not many female sperm whales and calves around during the winter months. Working earlier in the year has given us the opportunity to see that females and calves are present at this time of year as well as during the summer months. Some opportunistic trips to sea in the winter have shown the presence of females and calves over winter too. In future, we would like to expand the effort to include more time at sea in the winter months, to see if some groups of females and calves are present in the archipelago all year round as residents, rather than just repeat visitors.

Photo-identification of sperm whales began in the Azores in 1987 and over 3,000 individuals have been identified since then (just under 600 new individuals during expeditions). The Europhlukes matching program, designed in 2002, made matching individuals much faster than when done manually by eye. Since 2021, a new online matching algorithm for sperm whales, designed during Capgemini's "Global Data Science Challenge" and incorporated into "Happywhale" www.happywhale.com has made most matching even faster. Although when a match is not made online, the old Phlex & Match programs still need to be used, because not all researchers upload their photos.

Photo-ID work by other researchers has shown that some bottlenose and Risso's dolphin are resident in the islands year-round, and there are a few transient groups just passing through (Silva 2007, Hartman 2014). Preliminary analysis of false killer whales shows that this species may also be resident around the archipelago, rather than restricted to the Central Group of Islands (Steiner et al. 2019). There are matches of false killer whales between the Faial/Pico area to both Teceira and Sao Miguel. Some individuals have been observed since 2005. To date, no matching has been done outside of the archipelago.

By photographing individual dolphin we can start to see patterns of habitat use by different groups of dolphin at different times of year and compare ID photos to existing catalogues, to determine what home ranges might exist for these resident individuals. This requires a lot of time spent matching ID photos to identify individuals and their groups. Most of this work will be done in the future.

2.2. Methods

The *Physeter* (Latin for sperm whale), a 12 m motor catamaran, was used to go to sea on days when weather conditions permitted this. Vigias, local lookouts, were located on the cliffs about 150 m above sea level, where they began to look for whales at around 07:30 to be able to direct the boat, on its departure at 09:00 (Fig. 2.2a).

Figure 2.2a. Vigia Marco Medeiros on Monte da Guia.

If the lookouts did not spot any whales, the boat was equipped with a towed hydrophone to attempt to locate sperm whales acoustically. The boat also had up to three additional lookouts onboard, two on the bow (Fig. 2.2b) and one looking aft (behind the boat) searching for cetaceans.


Figure 2.2b. Observers on the bow.

Two citizen scientists were tasked with filling in POPA forms (transects, random cetacean sightings, bird, turtle and trash surveys) (Fig. 2.2c). Other citizen scientists were on hydrophone monitoring (Fig. 2.2d), camera duty (Fig. 2.2e), data sheets, recording the track of the boat (and sightings) on a Montana GPS or collecting water temperatures when required. The aft lookout was also responsible for collecting data on the Monicet App. On occasion, crew members may have had to do more than one job at a time.


Figure 2.2c. POPA sheet duty.

When found, sperm whales were approached from behind in order to obtain fluke photographs and in accordance with the whale watching regulations. Baleen whales were also approached from behind, but moving further forward to obtain photographs of dorsal fins. Bottlenose and Risso's dolphins and false killer whales were also paralleled in order to obtain dorsal fin photographs for identification of individuals. Other dolphins sighted were approached for species identification. If the species was not a target species, the boat usually moved on to look for other target animals.

Figure 2.2d. Hydrophone deployment and listening.

Figure 2.2e. Camera duty with support from an observer.

Two cameras were used to obtain the ID photographs: A Canon 7D MK II with a Canon 100-400 mm lens and a Canon 70D with a 70-300 mm lens.

Data collected for non-sperm whale sightings included: start and end time of the encounter, position of the sighting as well as number of animals, presence or absence of calves and general behavioural state (milling, feeding, bowriding or travelling). Only four categories of behaviours (milling, travelling, bowriding or feeding) were differentiated, because generally not enough time could be spent with the animals to break behaviours down further. If the animals were travelling, the direction of travel was noted. In addition, environmental information was also recorded including: water temperature, wind speed and direction, sea state (Beaufort scale), and visibility. The number and behaviour of birds associating with the dolphins or whales were also recorded, as was the presence of other whale watching vessels. All sightings were treated as separate encounters, unless more dolphins were seen within two to three minutes of ending the previous encounter, then the maximum number of dolphins and end time were adjusted.

Data collected for sperm whale sightings included: date, start and end time, number of whales, number of calves (the calves also count in the whale column), if the calf was suckling, if there was a visible callous (a growth on the top of the dorsal fin, which indicates that the whale is female) or, if the whale was male, position, fluke heading, defecation and the presence of other whale watching boats.

When loggerhead turtles were sighted, their position was recorded on POPA forms. If conditions were good and we were not heading to another sighting, an attempt to catch the turtle was made and, if successful, it would be measured and tagged with stainless steel flipper tags for the University of Florida / University of the Azores turtle tagging programme.

When the boat returned to port, there was a debriefing on board (Fig 2.2f) to show where the boat had been during the day, using a nautical chart. Later, sperm whale photos taken during the day were matched to the catalogue.

Figure 2.2f. Debriefing

Results were analysed using Excel data analysis tools. Summary statistics obtained thus were used to obtain average group sizes and ranges. Sightings of most species in 2023 were not sufficient to use other statistics.

2.3. Results

2.3.1 Effort

The research vessel Physeter normally left the harbour around 09:00 and returned around 16:00, weather permitting. The boat went to sea for fifteen days during the expedition and spent between 2 and 8 hours (h) per day on the water, the average being 6.38 h. A total of 93.7 h with sea conditions below sea state 5 were spent at sea. A comparison of the yearly effort since 2004 is shown in Fig. 2.3a. It should be noted that prior to 2009, the expedition duration was 13 days, which has since been reduced to 10 days. Also of note is that in 2009, 2011, 2013 and 2015 there were no expeditions in May. In 2018 the expedition began in March for the first time, with no groups in May. There were no expeditions in 2017 (due to lack of citizen scientists), 2020 and 2021 (due to COVID-19).

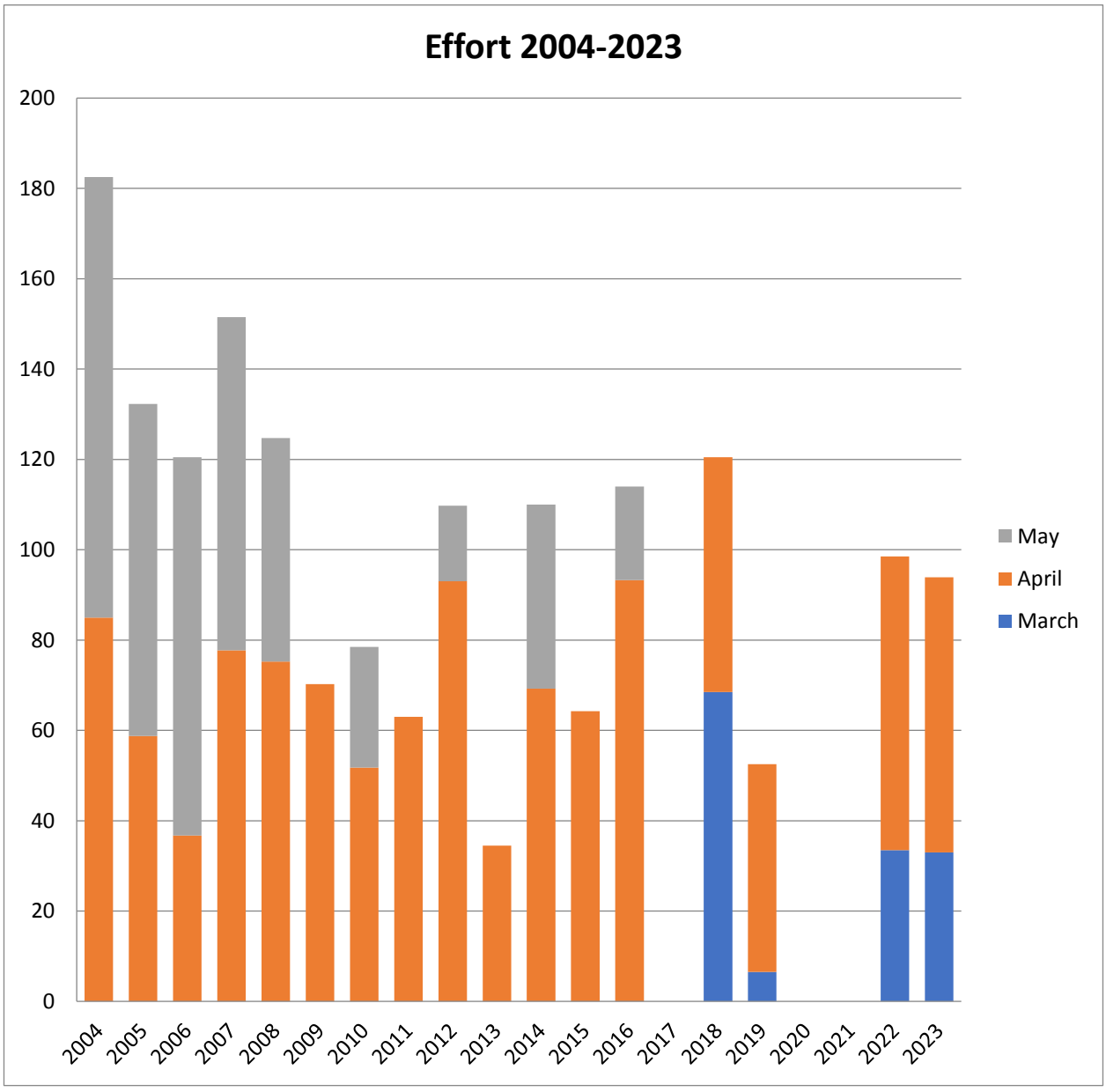


Figure 2.3a. Yearly effort (in hours) 2004-2023.

2.3.2. Encounters

During the 2023 expedition, 85 groups of non-sperm whales from nine different species and 87 sperm whale encounters were recorded (Table 2.3a).

Table 2.3a. Cetaceans encountered by the expedition.

COMMON DOLPHIN, *Delphinus delphis*	49
RISSO'S DOLPHIN, *Grampus griseus*	2
BOTTLENOSE DOLPHIN, *Tursiops truncatus*	10
STRIPED DOLPHIN, *Stenella coeruleoalba*	1
FALSE KILLER WHALE, *Pseudorca crassidens*	2
SEI WHALE, *Baleanoptera borealis*	8
BLUE WHALE, *Balaenoptera musculus*	4
FIN WHALE, *Balaenoptera physalus*	2
HUMPBACK WHALE, *Megaptera novaeangliae*	7
SPERM WHALE, *Physeter macrocephalus*	87

These encounters resulted in a relative sightings frequency shown in Fig. 2.3b. Sperm whales were the species encountered most frequently at 50% and, along with common dolphin at just under 30%, made up almost 80% of the sightings. Fig. 2.3c shows the relative frequency of the species without the two dominant species.

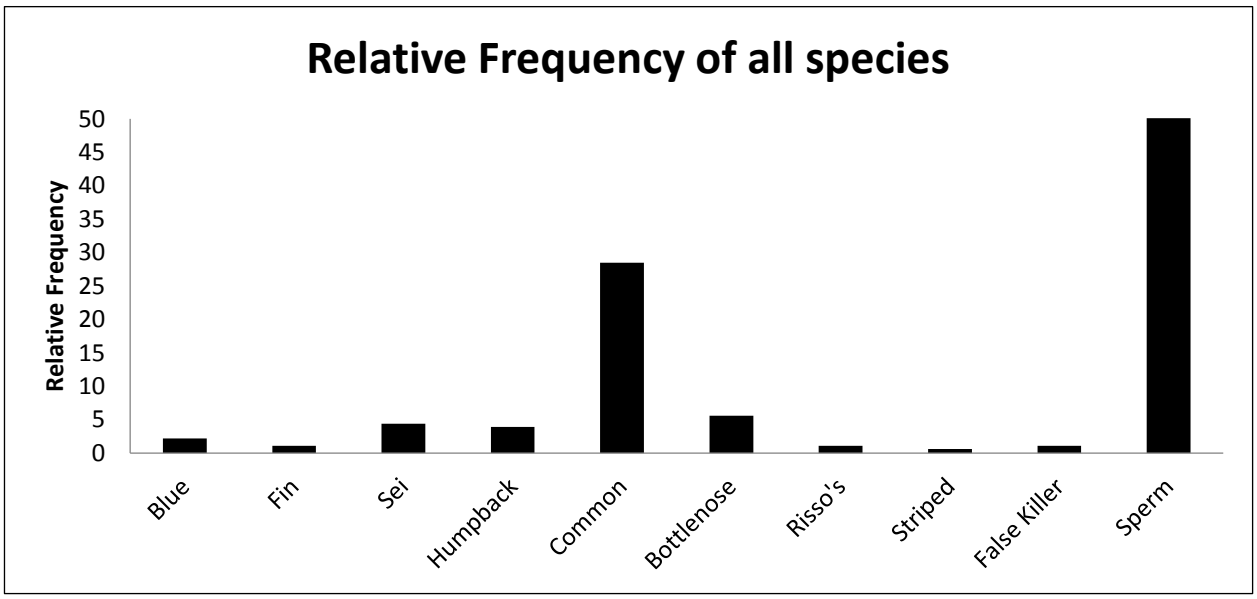


Figure. 2.3b. Relative sighting frequency of all species.

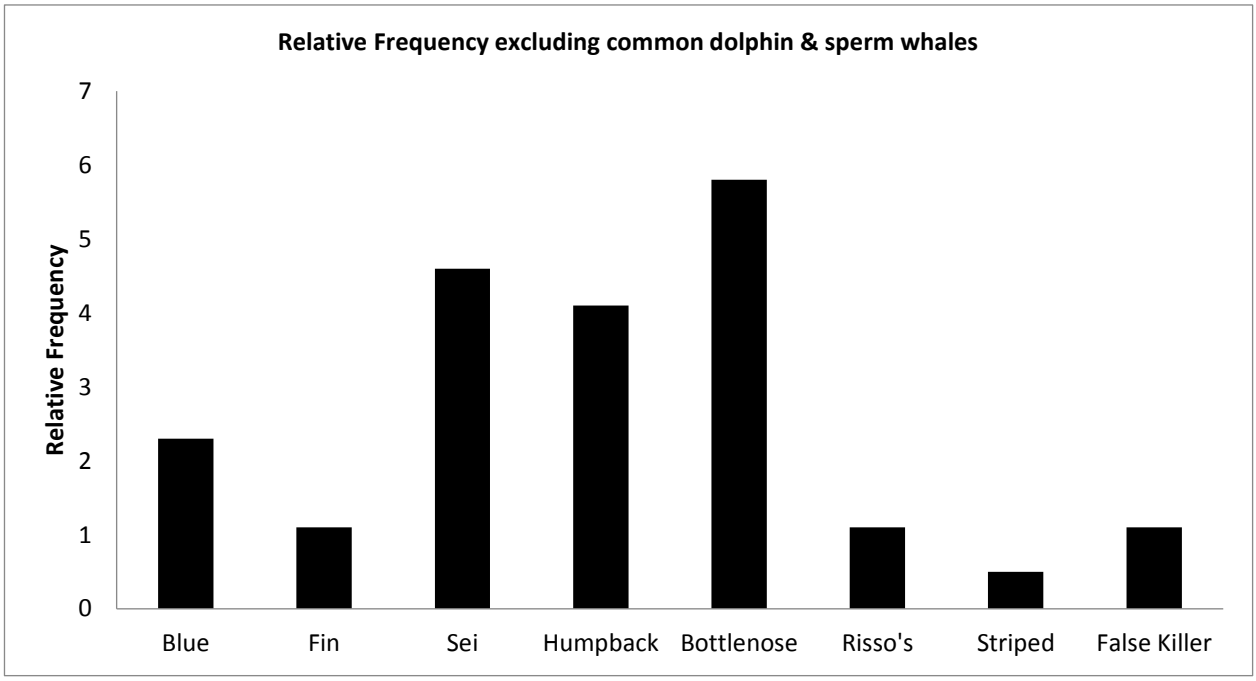


Figure. 2.3c. Relative sighting frequency excluding common dolphin & sperm whales.

Common dolphin

This species was encountered 49 times. Group sizes ranged from 1-400 with an average of 29 (Fig. 2.3d). This average group size is smaller than usually observed. Calves were first observed on 21 March 2023 and seen in fewer than 50% of sightings during the expedition. There was a significant difference in group size based on the presence of calves ($p<0.05$) (Fig 2.3e). It is generally thought that calves are present in larger groups, which provide greater protection for the youngsters (Schaffar-Delaney 2004, Tezanos-Pinto 2009).

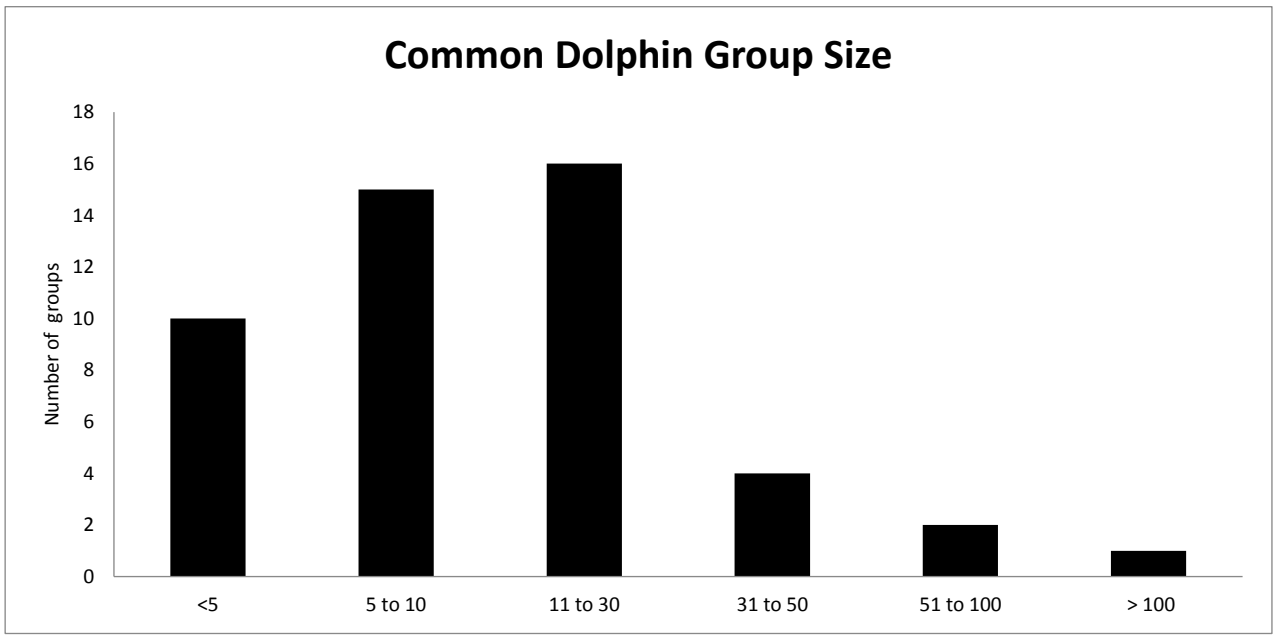


Figure 2.3d. Group size of common dolphin.

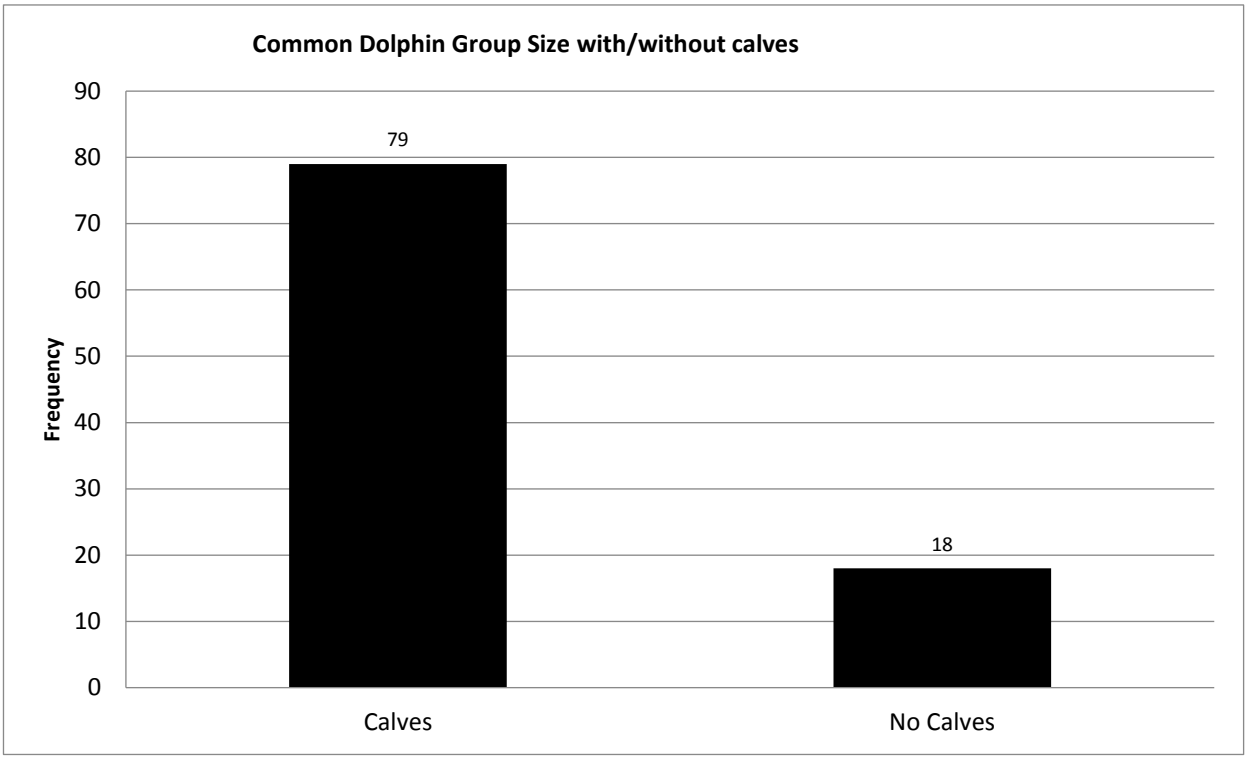


Figure 2.3e. Group size of common dolphin with and without calves.

Milling and travelling were the most common behaviours observed. They bowrode on just over 20% of encounters and were seen feeding in less than 10% of sightings (Fig. 2.3f).

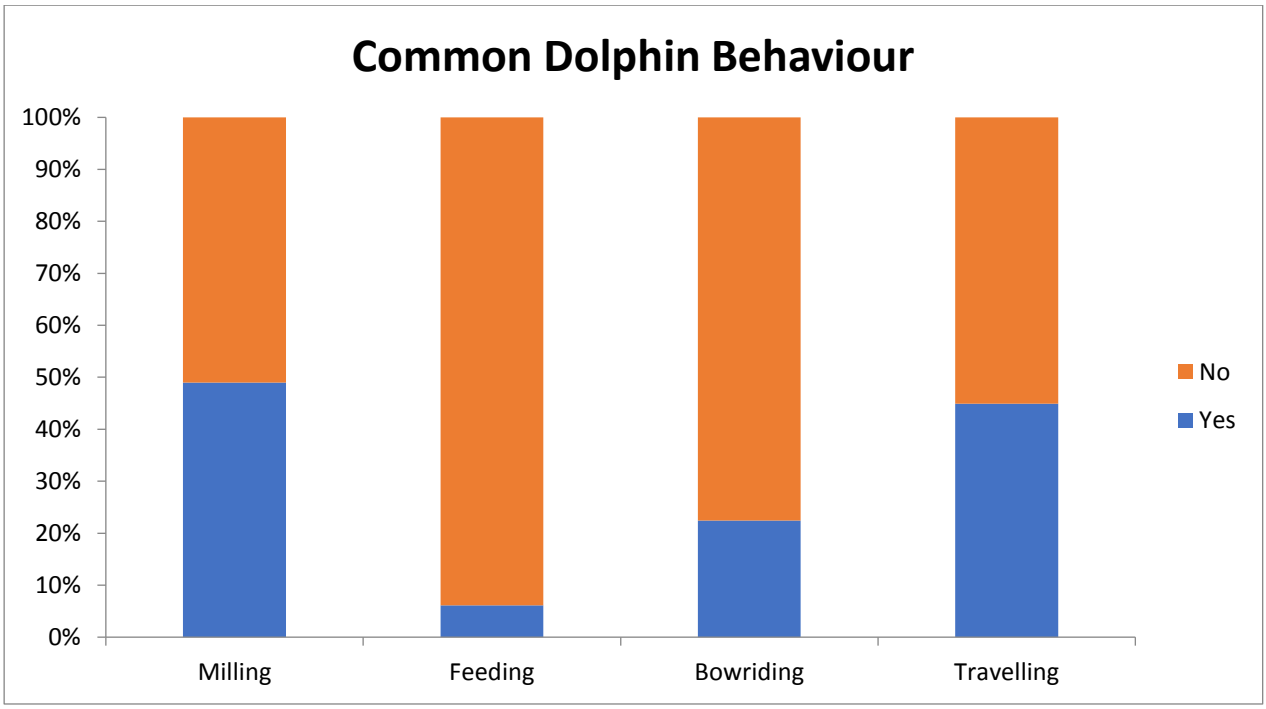


Figure 2.3f. Common dolphin behaviour.

Striped dolphin

One group of 50 striped dolphin was observed on 3 April 2023. There were calves present and the dolphins were milling.

Risso's dolphin

Two groups of Risso's dolphin were seen; no calves were observed in either group. Both groups were males usually seen around Faial (Karin Hartman pers. comm.). In the first group, two individuals were travelling and surfing in the waves. In the second group, six individuals were milling. Photographs were taken of both sides of the dorsal fin to identify individuals (Fig. 2.3g). The nicks in the back of the fin allow pairing of left and right sides, since the scarring is not the same on both sides.

Figure 2.3g. Risso's dolphin dorsal fin ID photos.

Bottlenose dolphin

Ten groups of bottlenose dolphin were seen. Group size ranged from 5-75 with an average of 28.5 (Fig 2.3h). Calves were seen in three of the ten groups. The group size was significantly larger when calves were present, 35 vs 11 ($p<0.05$), but this could be due to the low number of sightings without calves. Behaviour was evenly split between milling and travelling (Fig. 2.3i). Animals may have been feeding in one encounter, making dives of longer duration; bowriding was observed once. The animals appeared to be socialising on three occasions, with leaping observed. Photo-ID of the dorsal fins showed several of the well-known resident individuals and one individual with some severe nicks to the dorsal fin that had not been seen previously (Fig. 2.3j). Only one side of the dorsal is required, since it is the nicks in the trailing edge that are used for matching.

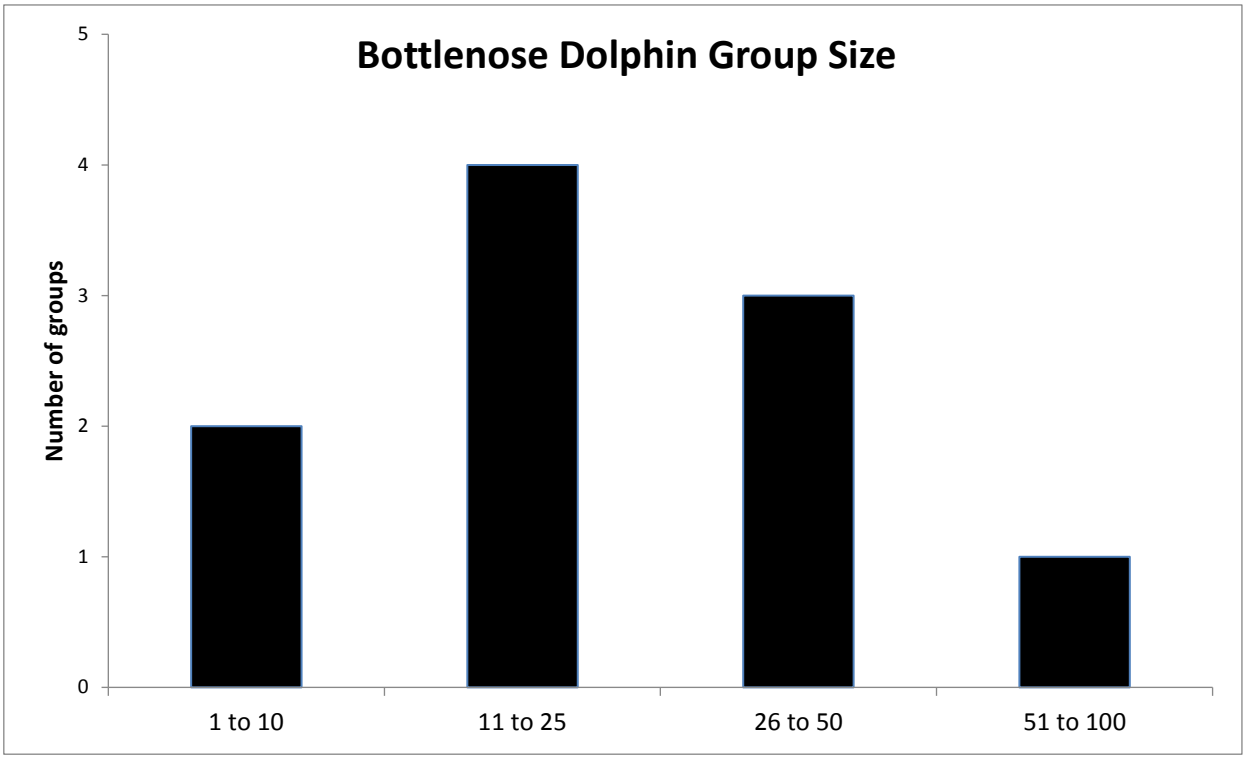


Figure 2.3h. Bottlenose dolphin group size.

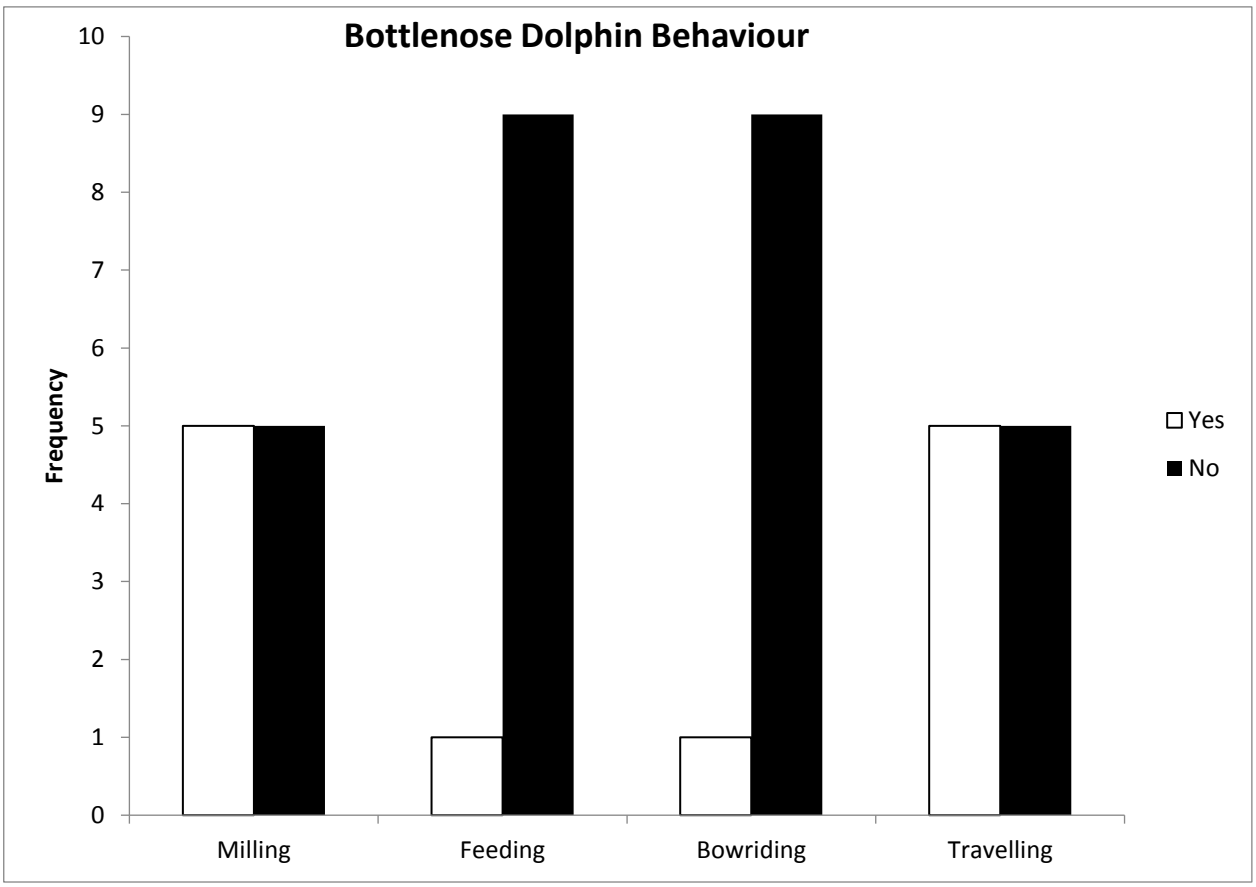


Figure 2.3i. Bottlenose dolphin behaviour.

Figure 2.3j. Bottlenose dolphin ID photos.

False killer whales

Two groups of false killer whales were seen 20 minutes apart; although it was likely to be only one group, spread out over a wide area, which is typical of false killer whales (Baird et al 2008, 2010, Bradford et al. 2014). There were calves in the main part of the group. A single individual was first observed travelling to the SE and 20 minutes later, the main part of the group, 40 individuals, was also travelling to the SE, probably feeding on tuna and bowriding. After feeding, the group started to socialise.

Photo-ID images were taken of dorsal fins to compare to the existing catalogue of false killer whales. After preliminary analysis, several individuals are known: from left to right and top to bottom AZPcA17 seen since 2005, AZPcB4 seen since 2007, AZPcA11 & AZPcA009 seen since 2009 (Fig. 2.3k). More analysis will be done when time constraints allow.

Figure 2.3k. False killer whale photo ID: from left to right and top to bottom AZPcA17 seen since 2005, AZPcB4 seen since 2007, AZPcA11 & AZPcA009 seen since 2009.

Blue whale

Four groups of blue whales were encountered during the expedition. In two of them single individuals were travelling NW. The other two encounters had feeding animals, one group had three individuals, although only one was identified. One individual of that group showed its fluke in the distance. Photo-ID pictures of the mottling patterns behind the head and around the dorsal fin were taken (Fig. 2.3i) and sent to Richard Sears at Mingan Island Cetacean Society (MICS), the College of the Atlantic, University of Virginia and The Bottlenose Dolphin Research Institute (BDRI) in Spain for matching to their Atlantic catalogues. No matches to other regions have been found during the expedition to date. However, two individuals were seen previously in the Azores, one in 2008 and another in 2009, but not by the author.

Figure 2.3i. Blue whale ID photos.

Fin whale

There were two sightings of fin whales during the expedition. One group of two individuals and a single animal were milling, possibly feeding. Fin whales are distinguished from other baleen whales by the white lower jaw on the right side of the animal (Fig. 2.3m). Individuals can be identified by the dorsal fin and the chevron pattern behind the blowhole on the right side (Fig. 2.3n). Unfortunately, the first individual did not show the dorsal fin and one of the pair did not show the chevron very well.

Figure 2.3m. Right lower jaw of a fin whale.

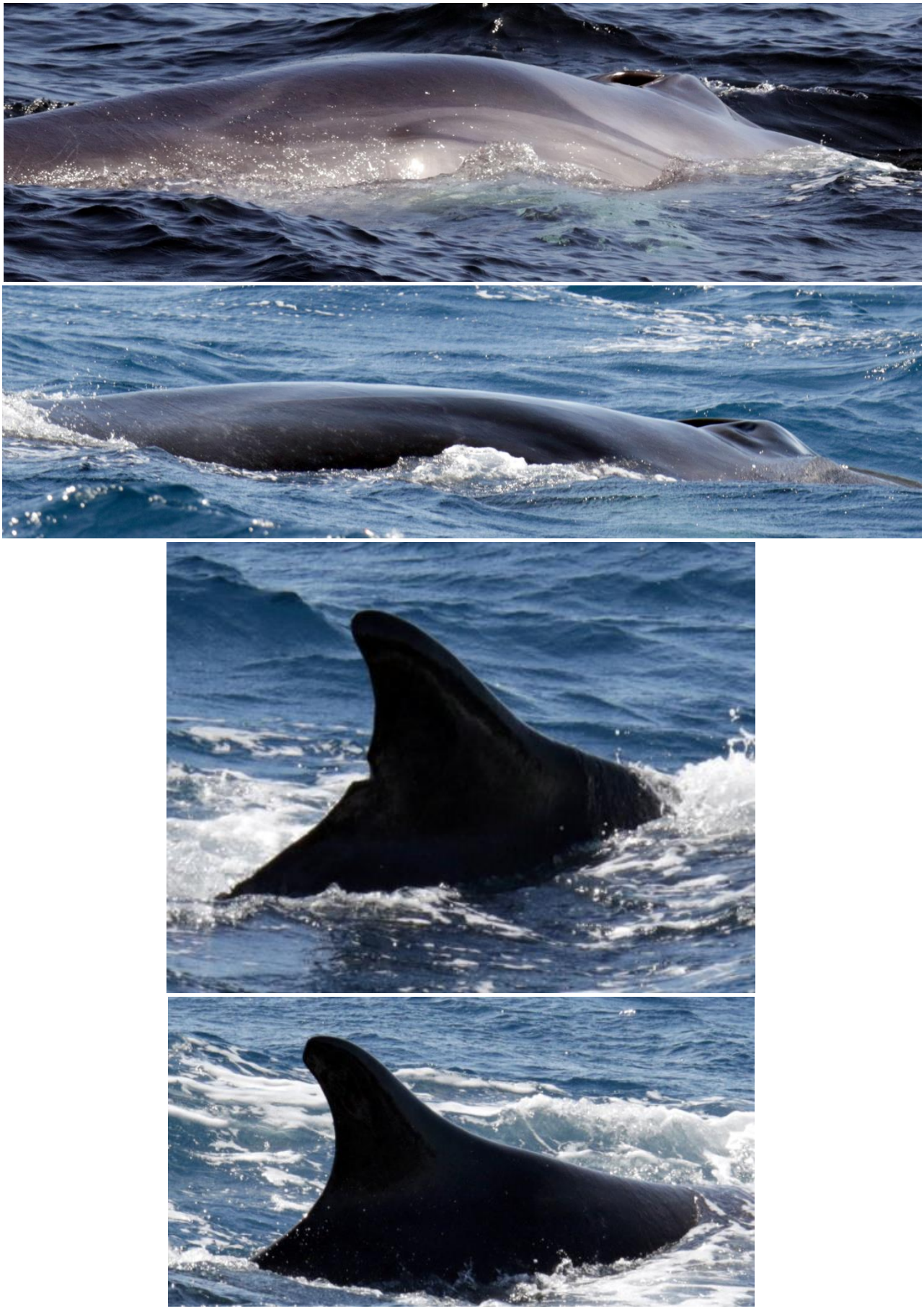


Figure 2.3n. ID photos: chevron (top two) and dorsal fin (bottom two) of fin whales.

Sei whale

Fourteen sei whales were seen over eight encounters. The lower jaw of sei whales is dark on both sides, distinguishing it from fin whales (Fig. 2.3o). In all but one of the encounters the whales were travelling: N, NW or W. During the other sighting, a single individual was thought to be feeding. The group size ranged from 1-3, with half of the groups comprising two individuals. No calves were seen. Individual sei whales are identified by their dorsal fin (Fig. 2.3p).

Figure 2.3o. Dark lower jaw of a sei whale.

Figure 2.3p. Photo-ID of sei whale dorsal fins.

Humpback whale

Humpback whales were observed seven times, although there were only three different animals. One individual was seen four times over three days and another was seen twice on the same day. The first animal was feeding alongside hundreds of Cory's shearwaters, it breached a couple of times, but did not show the fluke (Fig. 2.3q). Feeding was thought to be occurring in all the other encounters as well, although not at the surface. The group size was one for all encounters. Humpback fluke photos are used to identify individuals and, in some cases, dorsal fins can also be used (Fig. 2.3r)

Figure 2.3q. Humpback whale breach and feeding among shearwaters (continued overleaf).

Figure 2.3q. Humpback whale breach and feeding among shearwaters.

Figure 2.3r. Humpback whale fluke ID photos.

Sperm whale

Sperm whales are the main target species of the expedition. They were encountered 87 times, totalling 158 animals, although not all different individuals. Five males were seen. Thirty-two calves were seen in thirty encounters. Photographs were taken of all whales that fluked up. Individuals can be recognised by the nicks and scallops formed on the trailing edge of the tail, due mainly to wear and tear as the flukes beat through the water. 46 different individuals were identified. There were 16 re-sighted animals, including “1822” first seen in 1996, “2488” first seen in 2002, “2822” first seen in 2004, “3950, “3953” & “3966” both first seen in 2010 (Fig. 2.3s). There were 27 new individuals and three flukes that were not identifiable (Fig. 2.3t). The mean group size was 1.79, ranging from 1-7, which is similar to that encountered during other parts of the summer.

Figure 2.3s. Re-sighted sperm whales (from top 1822, 2488, 2822) (continued overleaf).

Figure 2.3s. Re-sighted sperm whales (from top 3950, 3953 & 3966).

Figure 2.3t. New sperm whale ID photos (continued overleaf)

Figure 2.3t. New sperm whale ID photos.

Miscellaneous sightings

Loggerhead turtles were observed eight times during the expedition. None were caught for tagging due to weather conditions, other research priorities or, on most occasions, the turtles diving (Fig. 2.3u).

Figure 2.3u. Loggerhead turtle.

Visualisations of group encounters and tracks

Figs. 2.3v-x show tracks and locations of species sightings in relation to the islands of Pico, Faial and São Jorge. They were recorded on the Montana GPS over the three expedition groups, with a summary for each expedition group at the end.

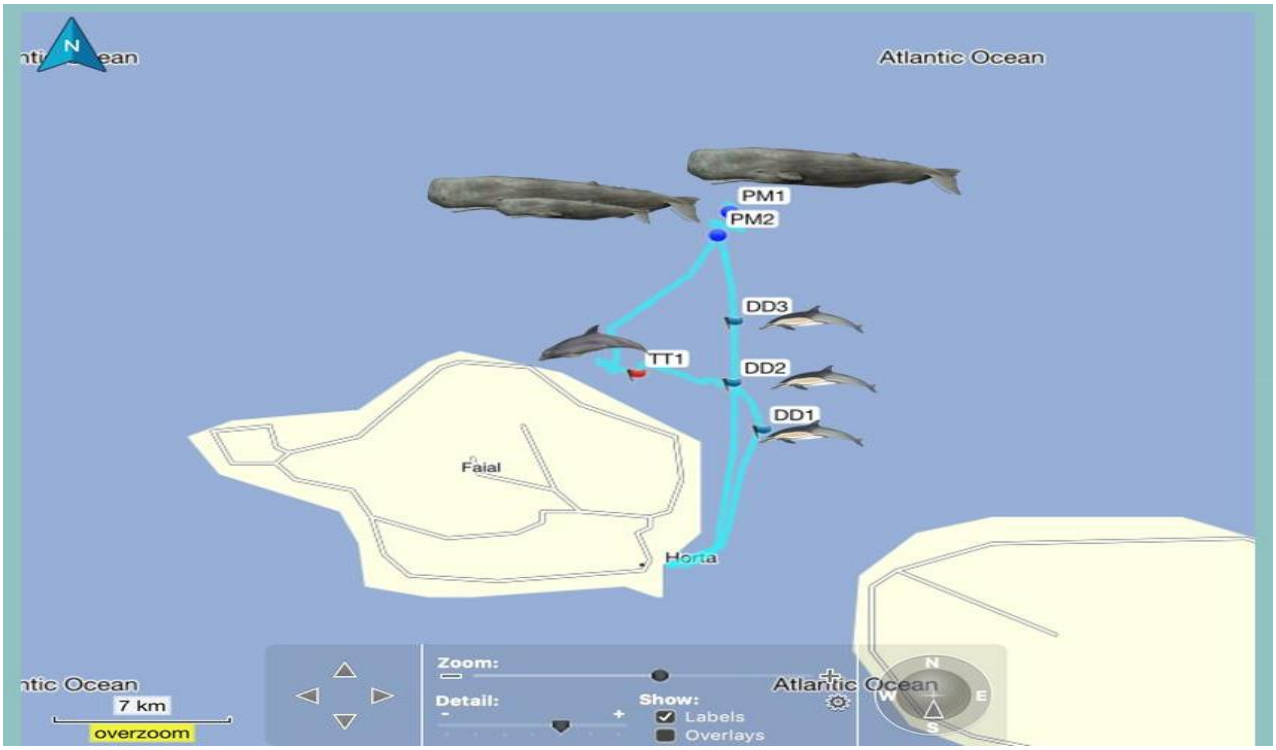
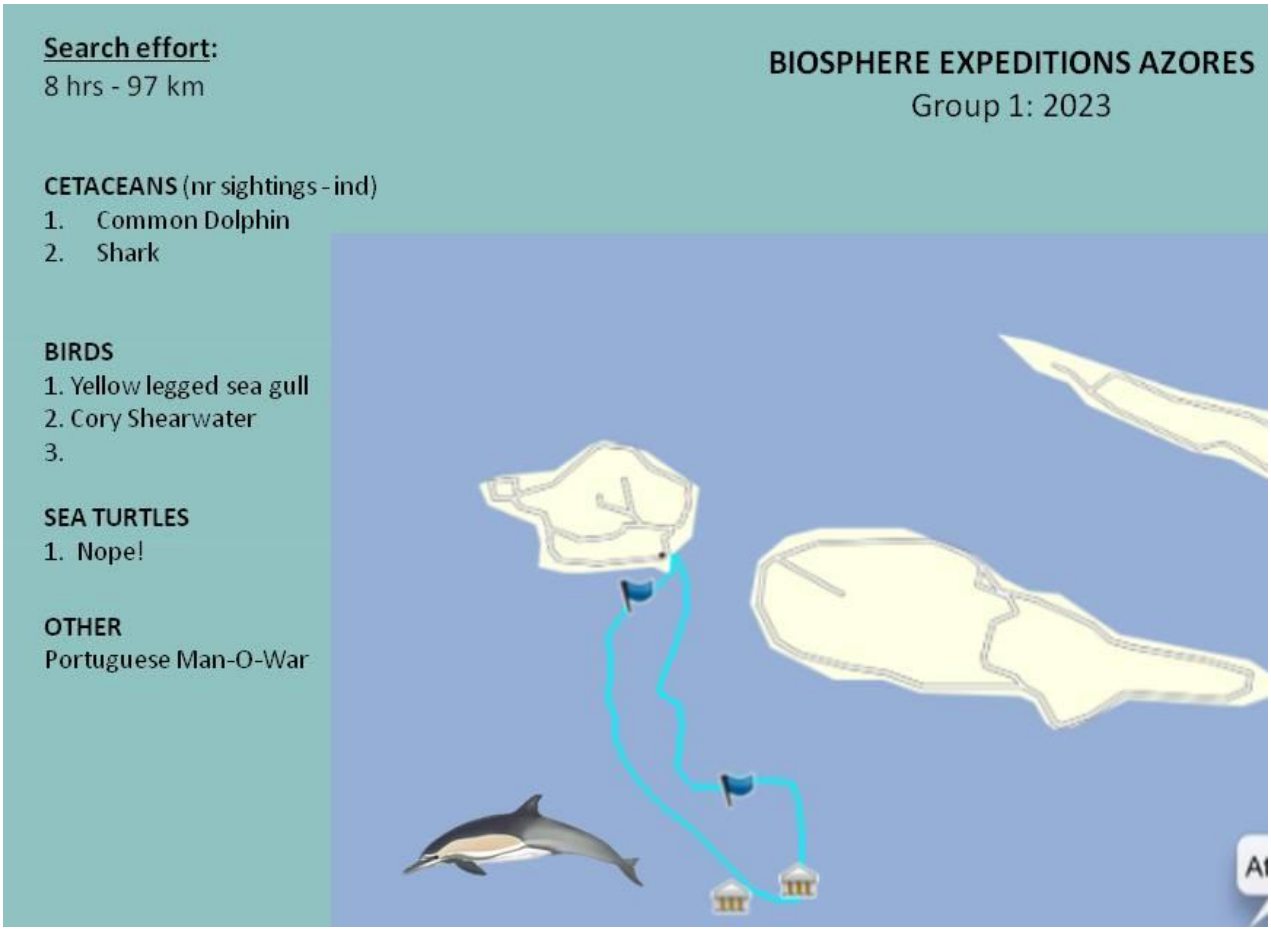


Figure 2.3v. Group 1 tracks and sightings (continued overleaf).



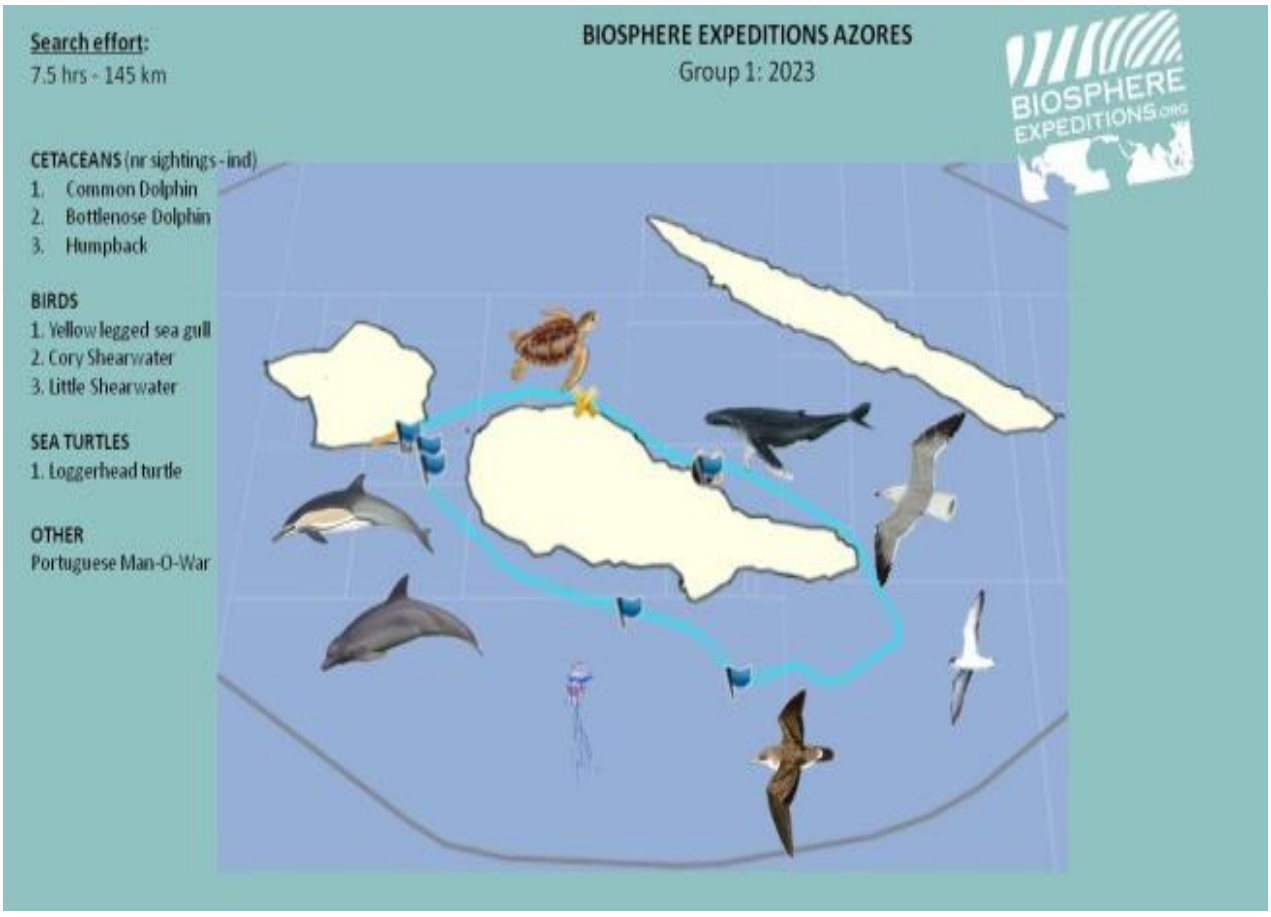
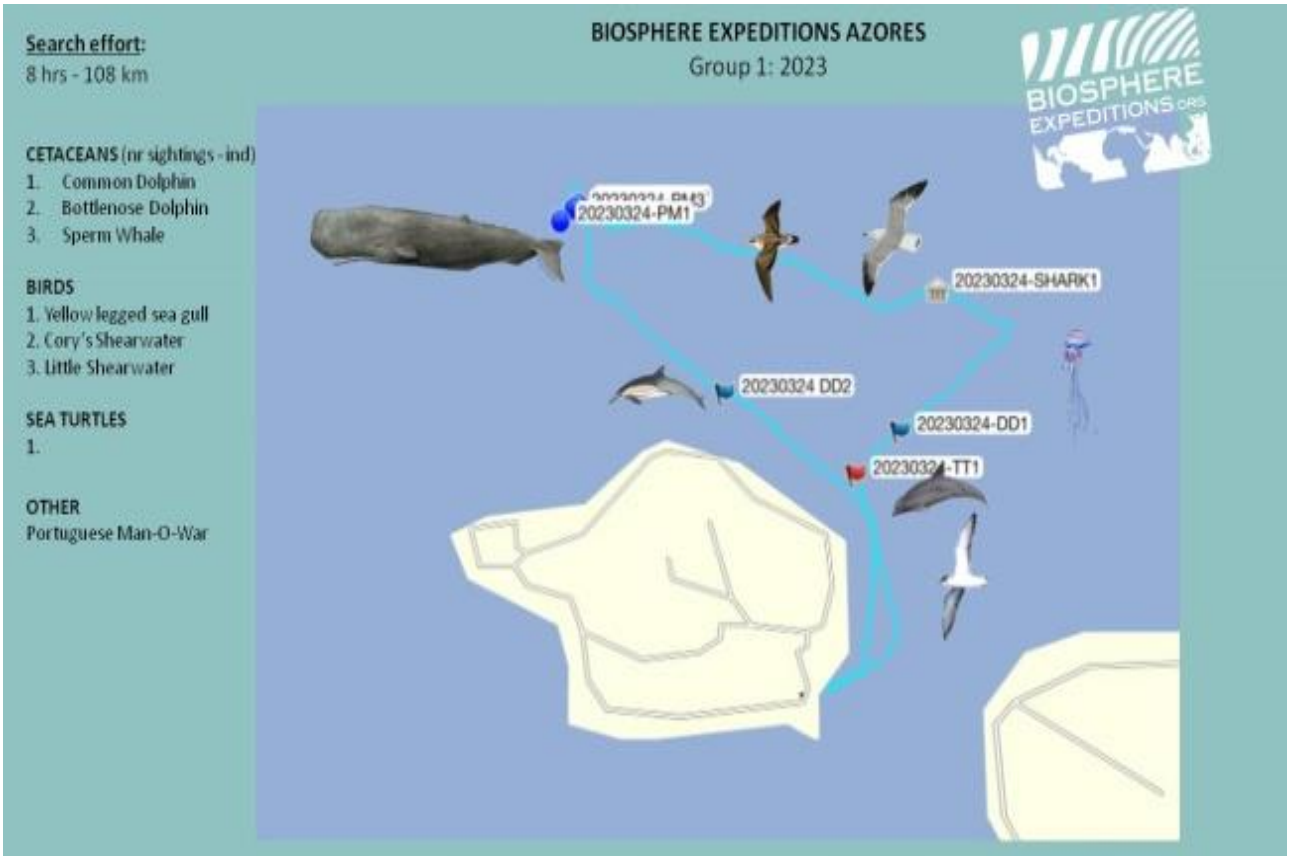


Figure 2.3v. Group 1 tracks and sightings (continued overleaf).



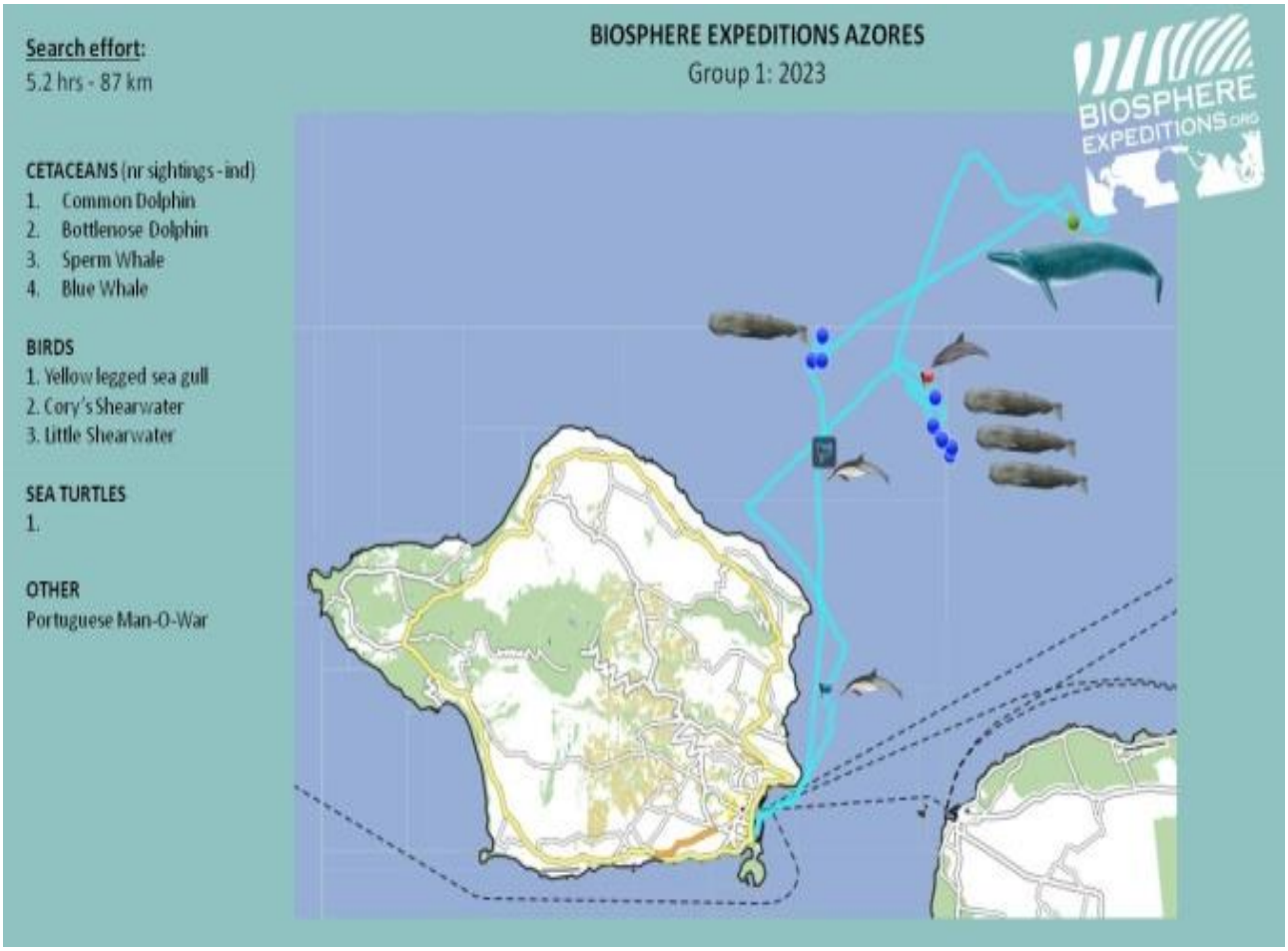


Figure 2.3v. Group 1 tracks and sightings (continued overleaf).

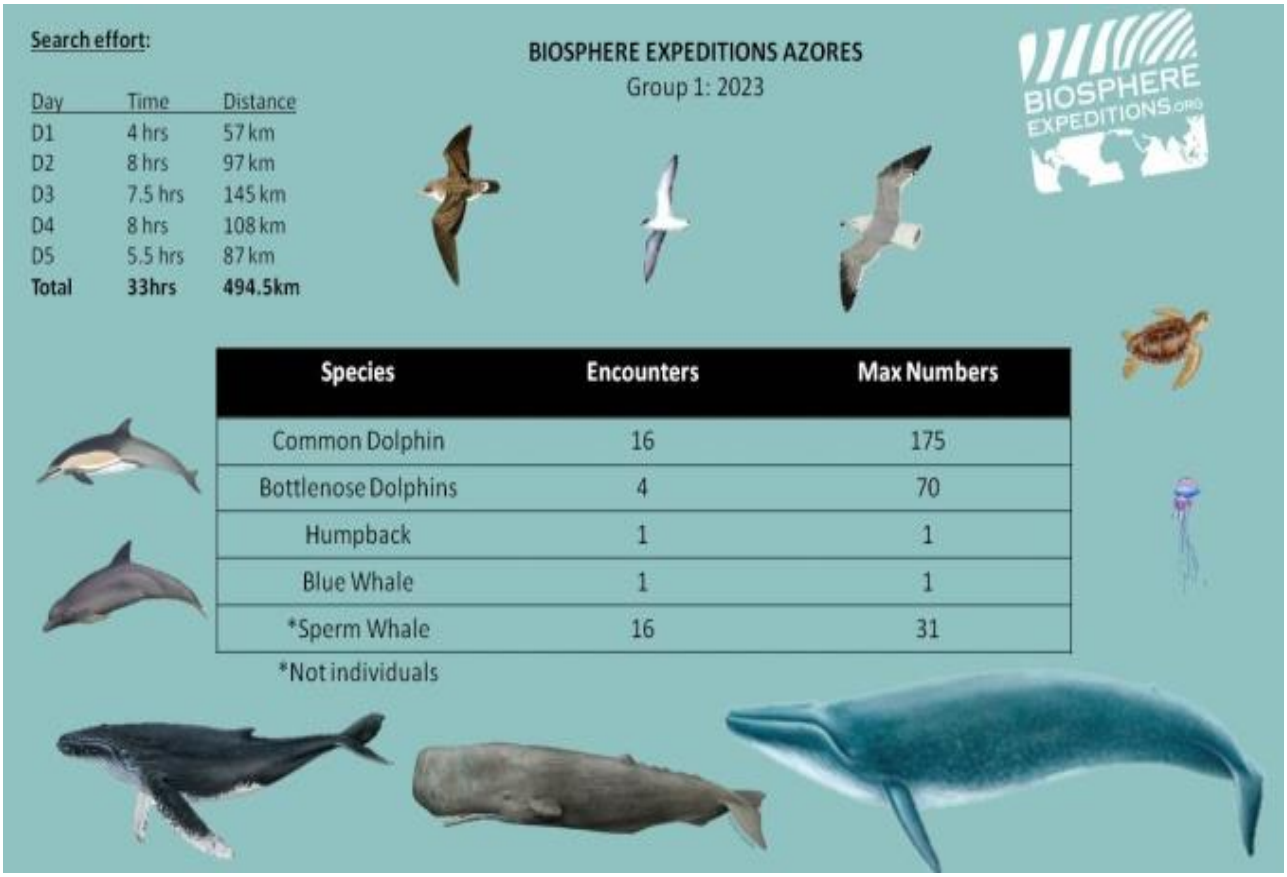


Figure 2.3v. Group 1 tracks and sightings.

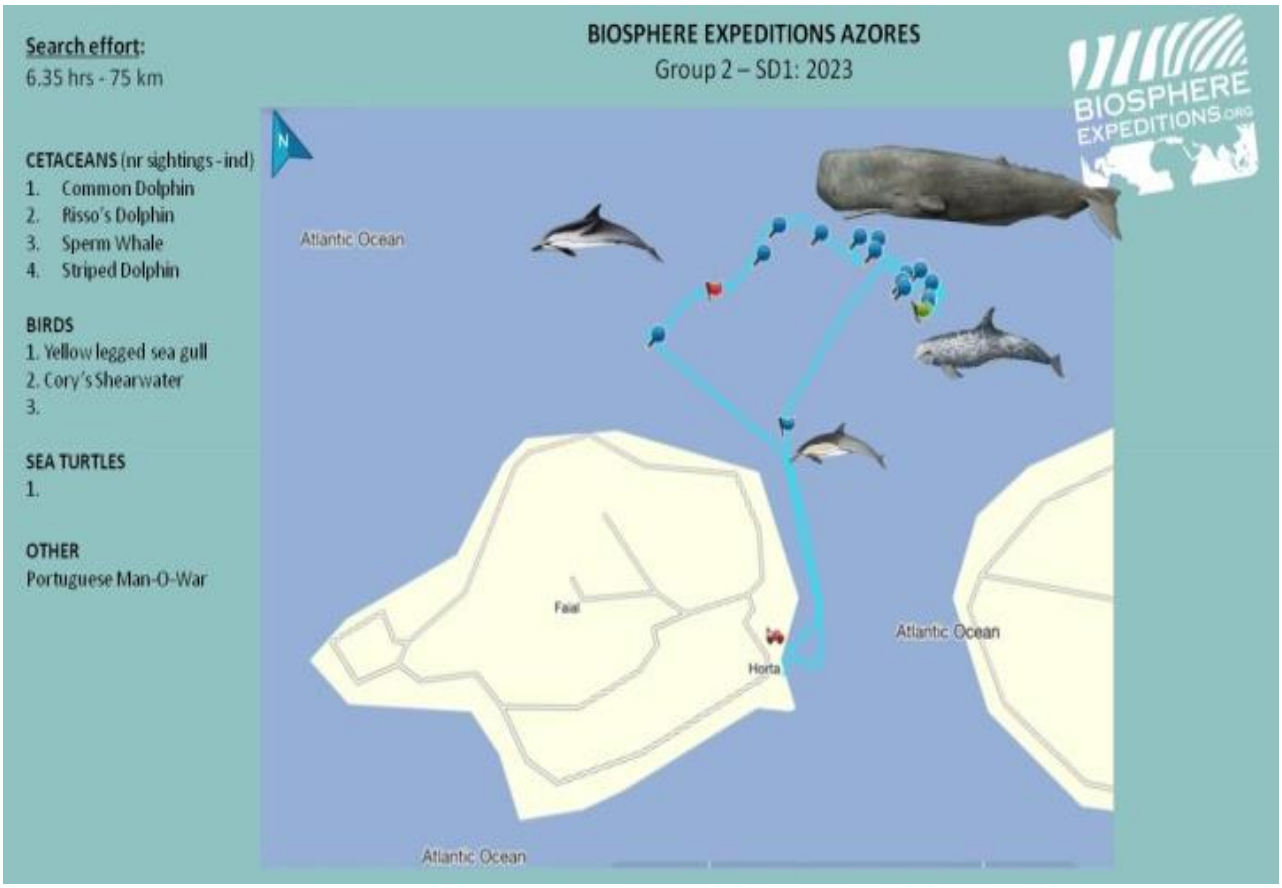
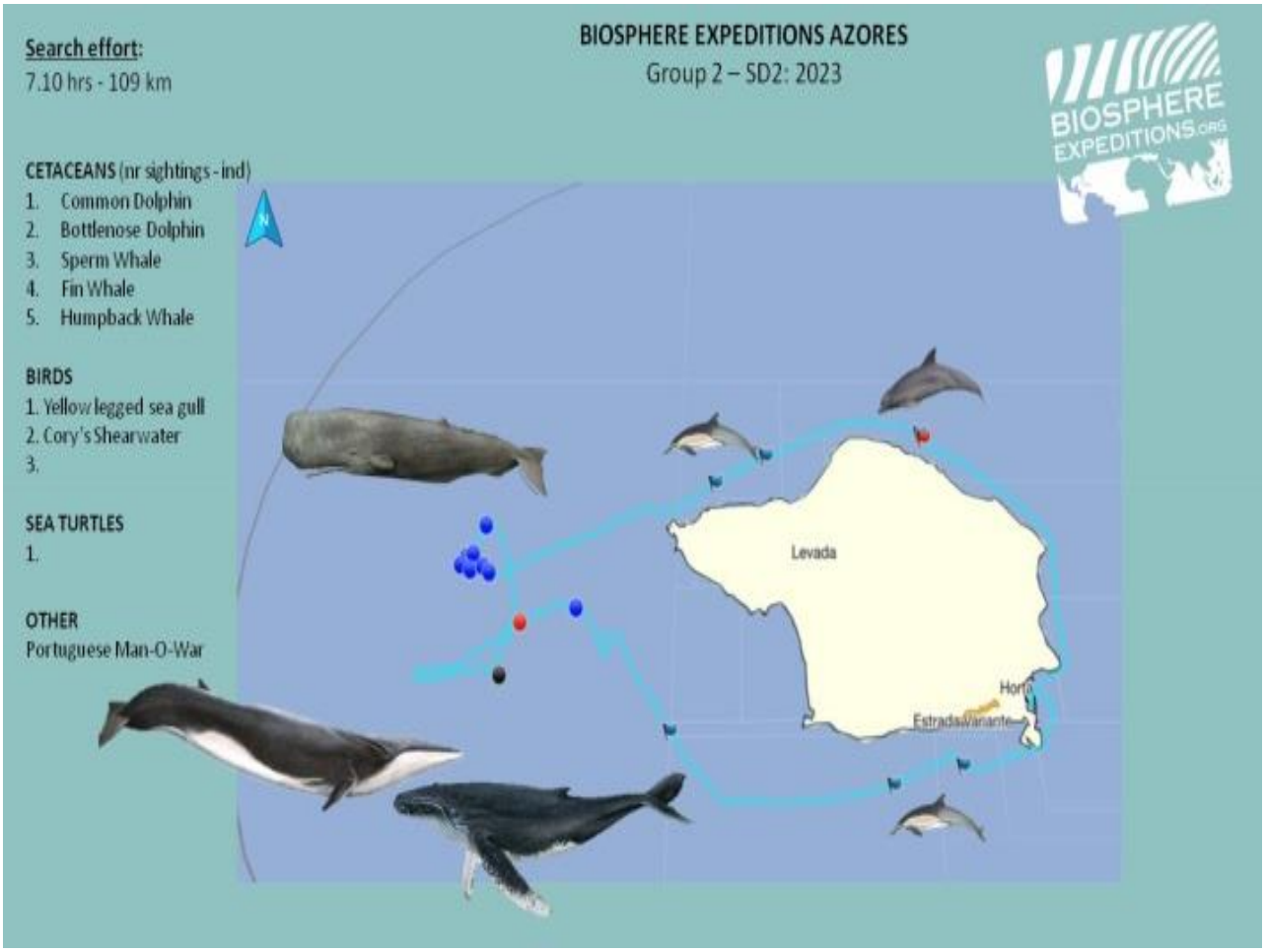


Figure 2.3w. Group 2 tracks and sightings (continued overleaf).



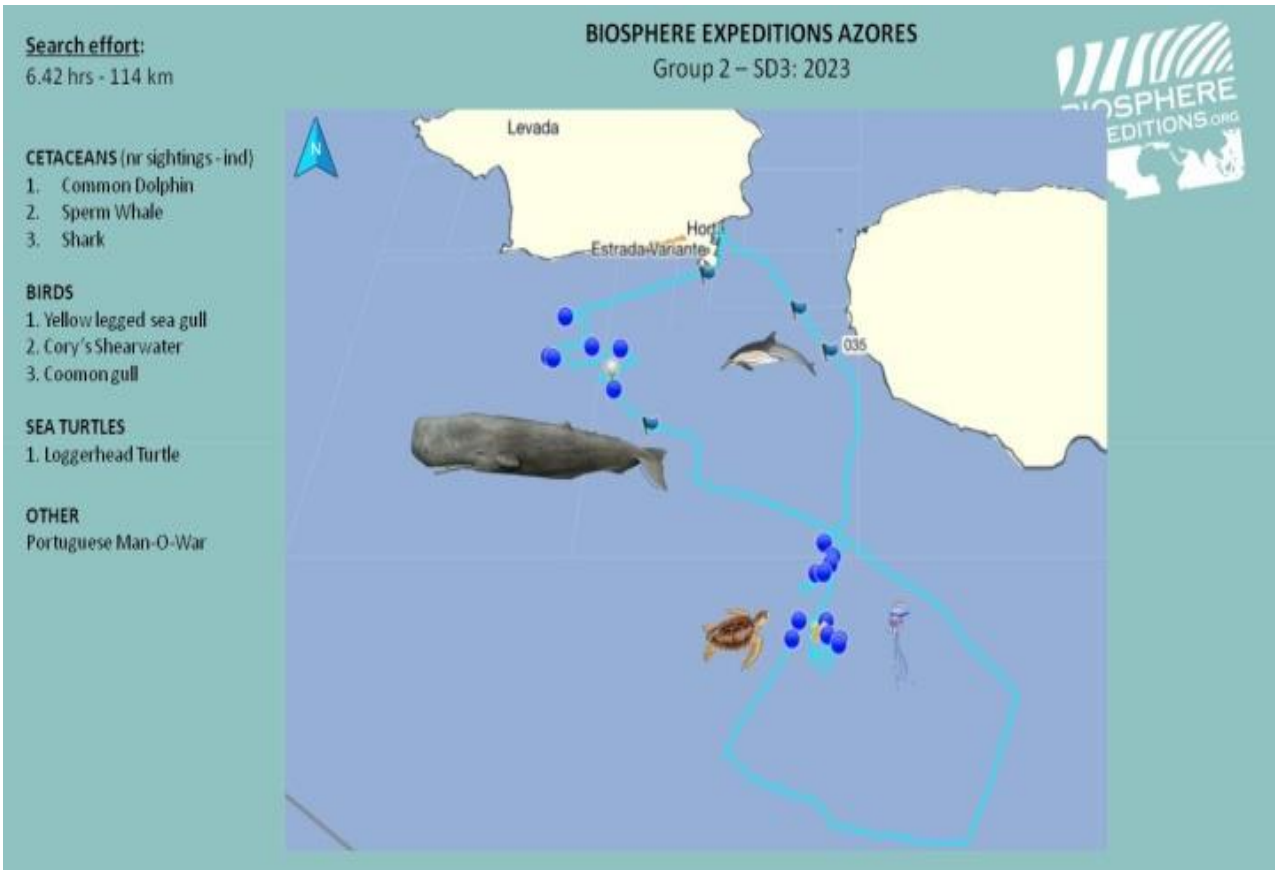
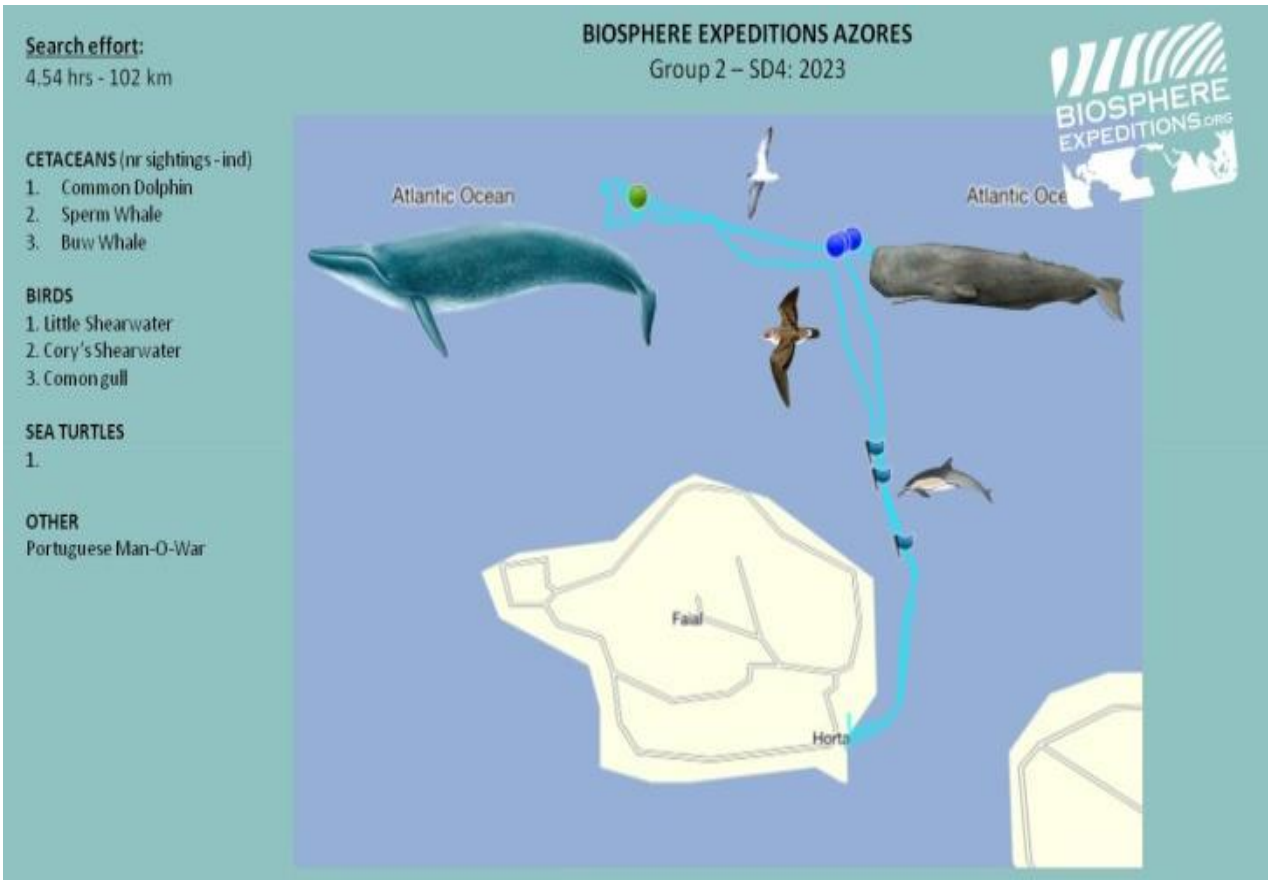


Figure 2.3w. Group 2 tracks and sightings (continued overleaf).



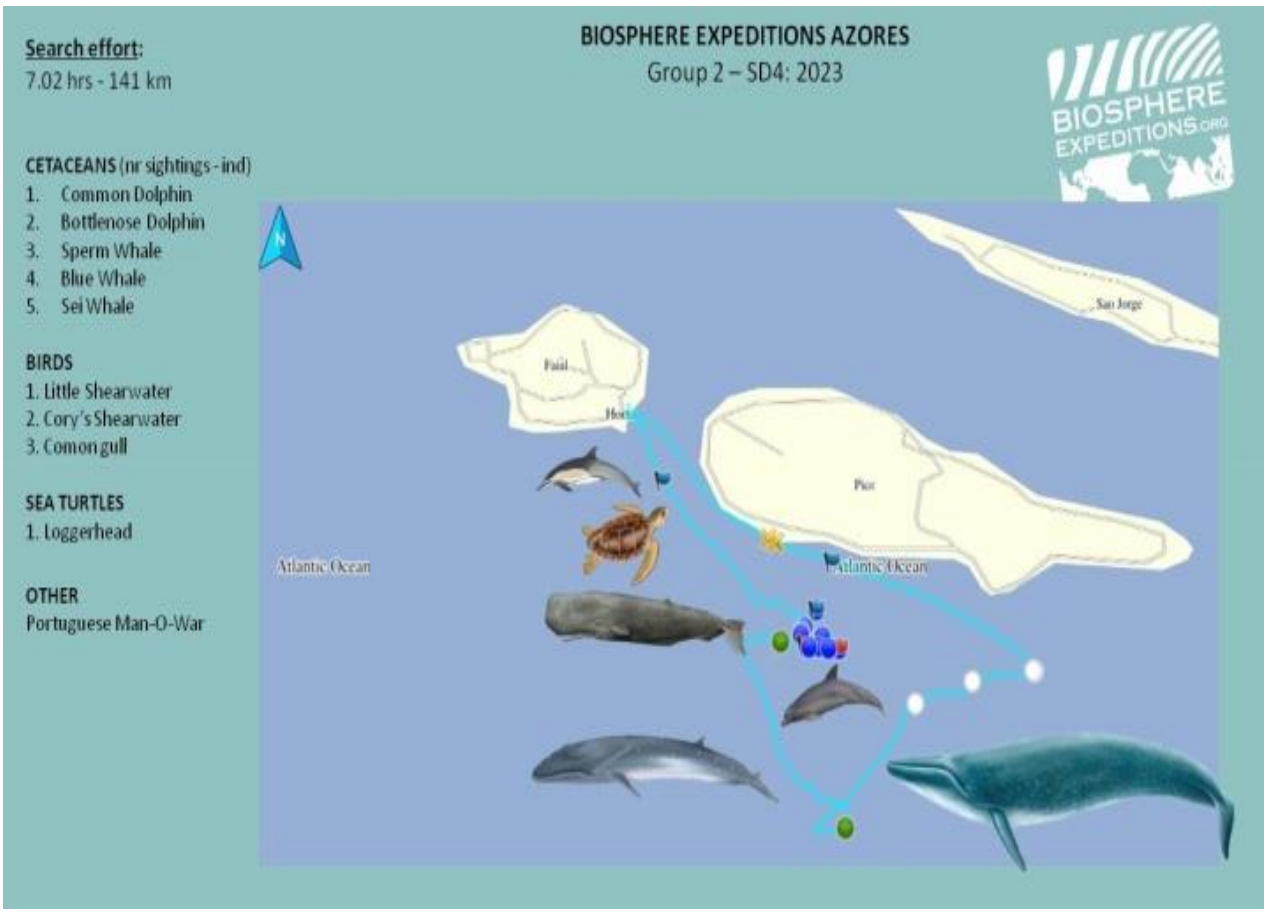


Figure 2.3w. Group 2 tracks and sightings (continued overleaf).

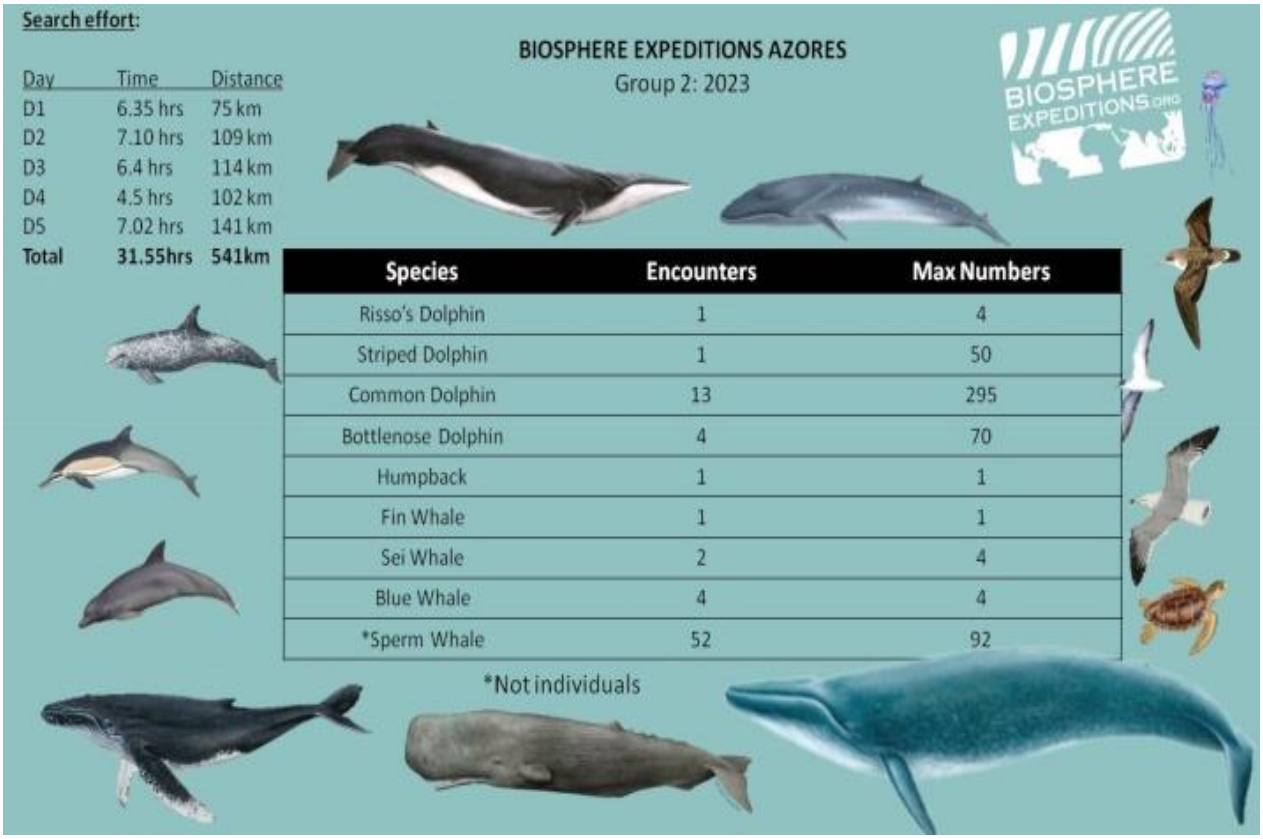


Figure 2.3w. Group 2 tracks and sightings.

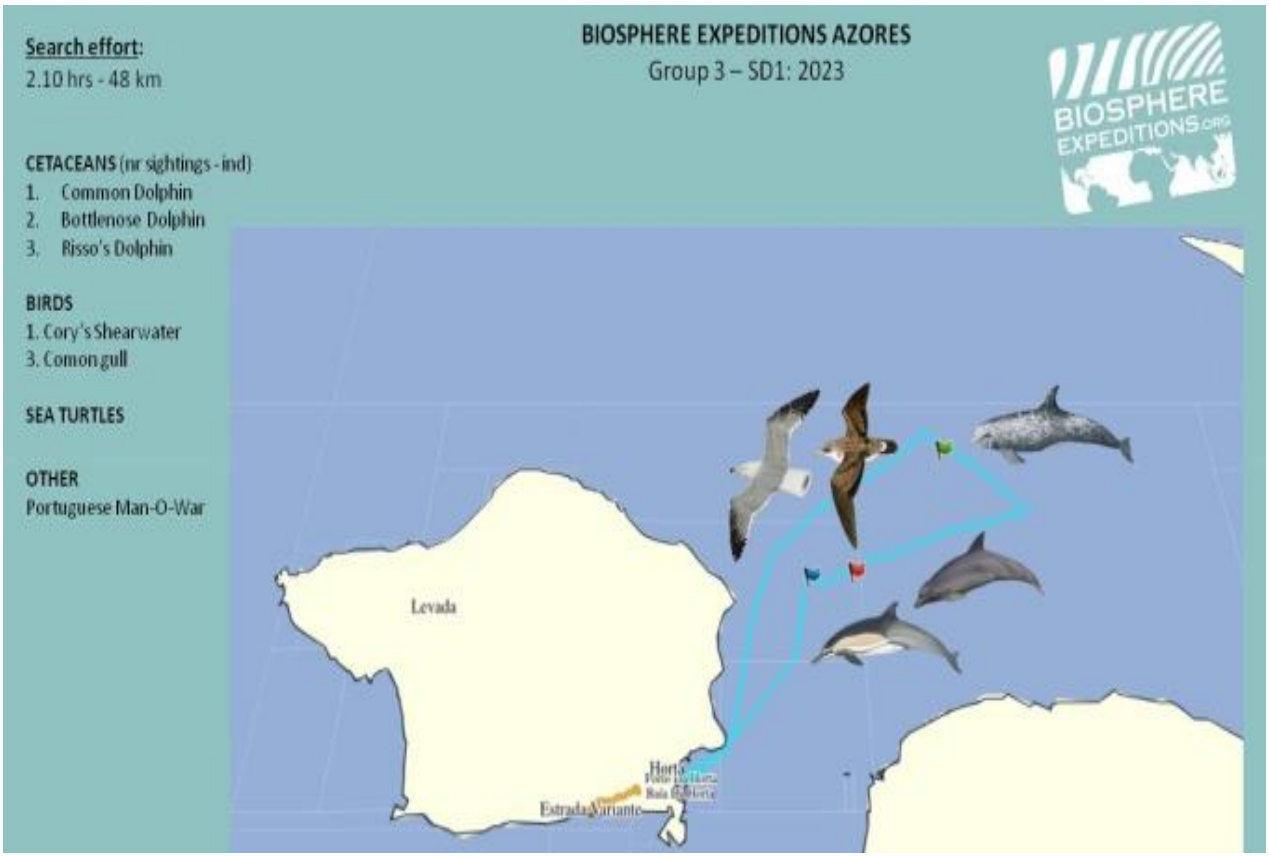
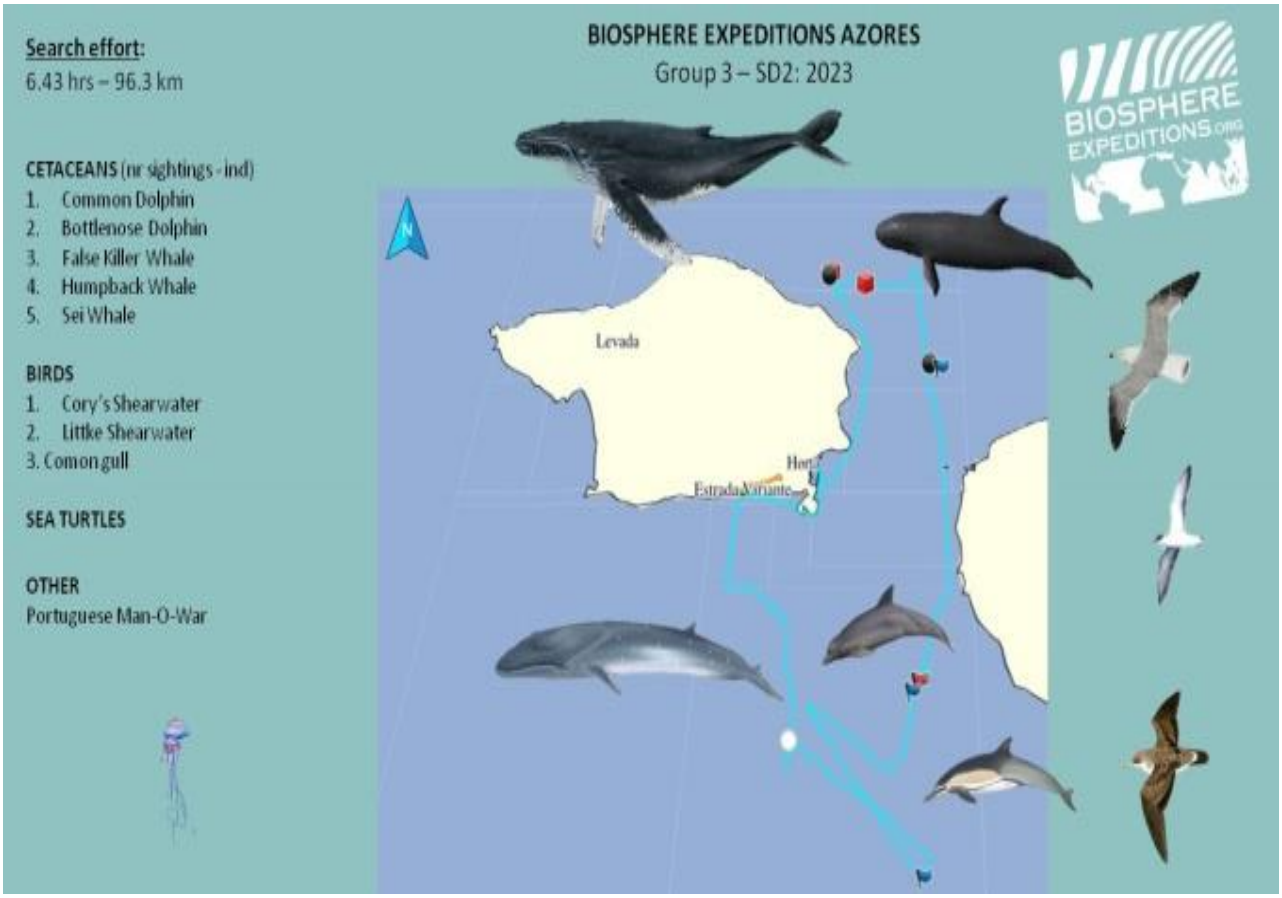


Figure 2.3x. Group 3 tracks and sightings (continued overleaf).



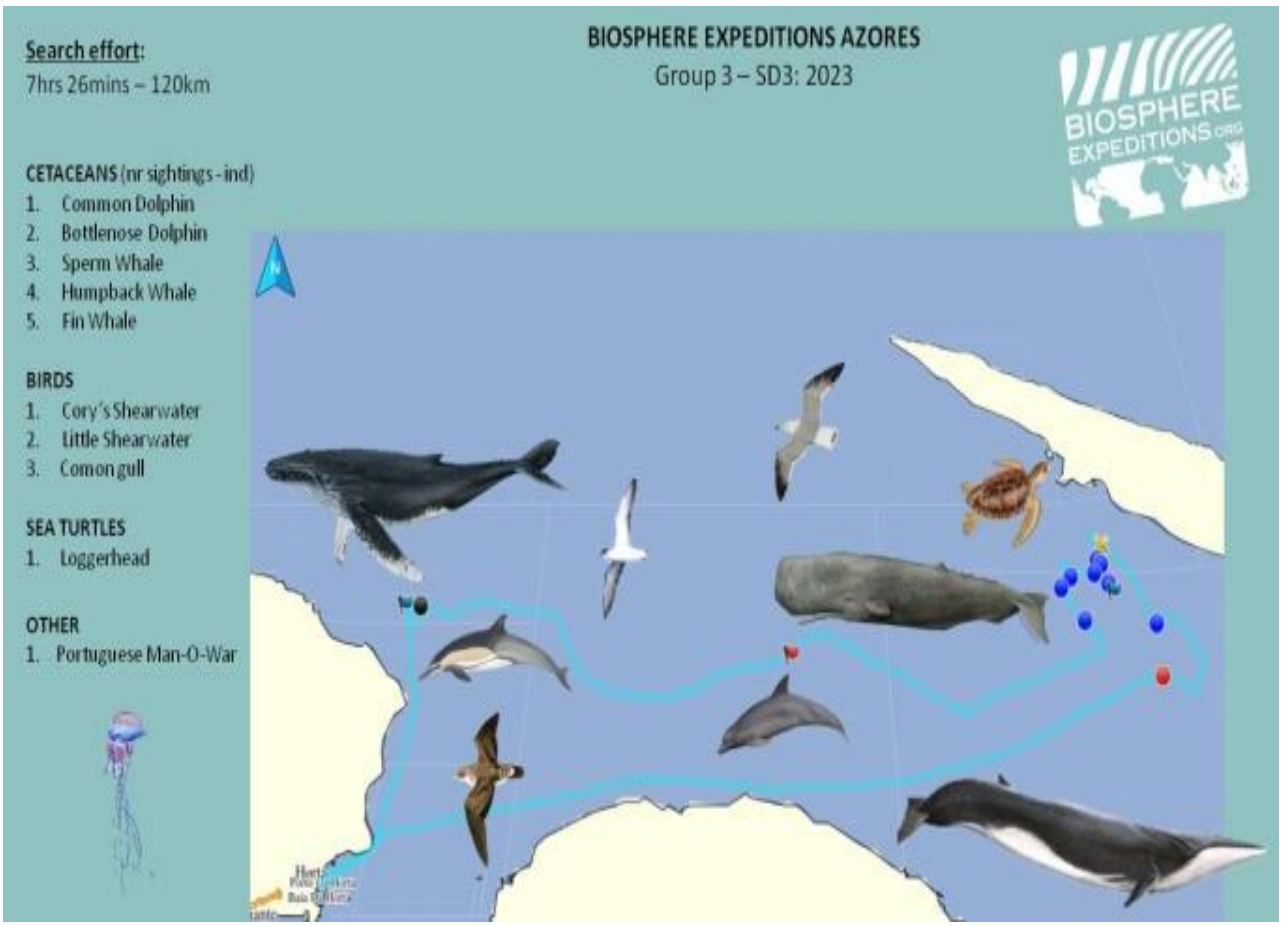
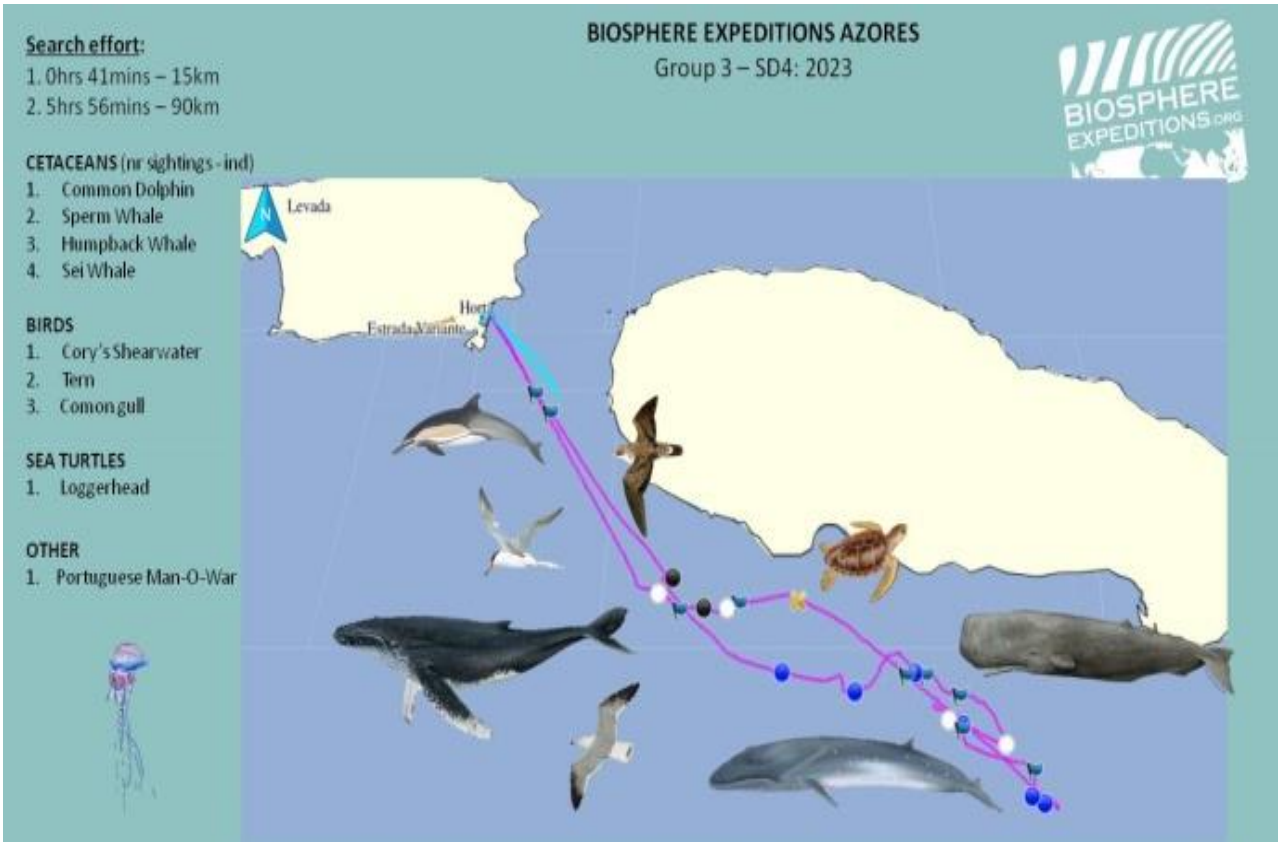


Figure 2.3x. Group 3 tracks and sightings (continued overleaf).



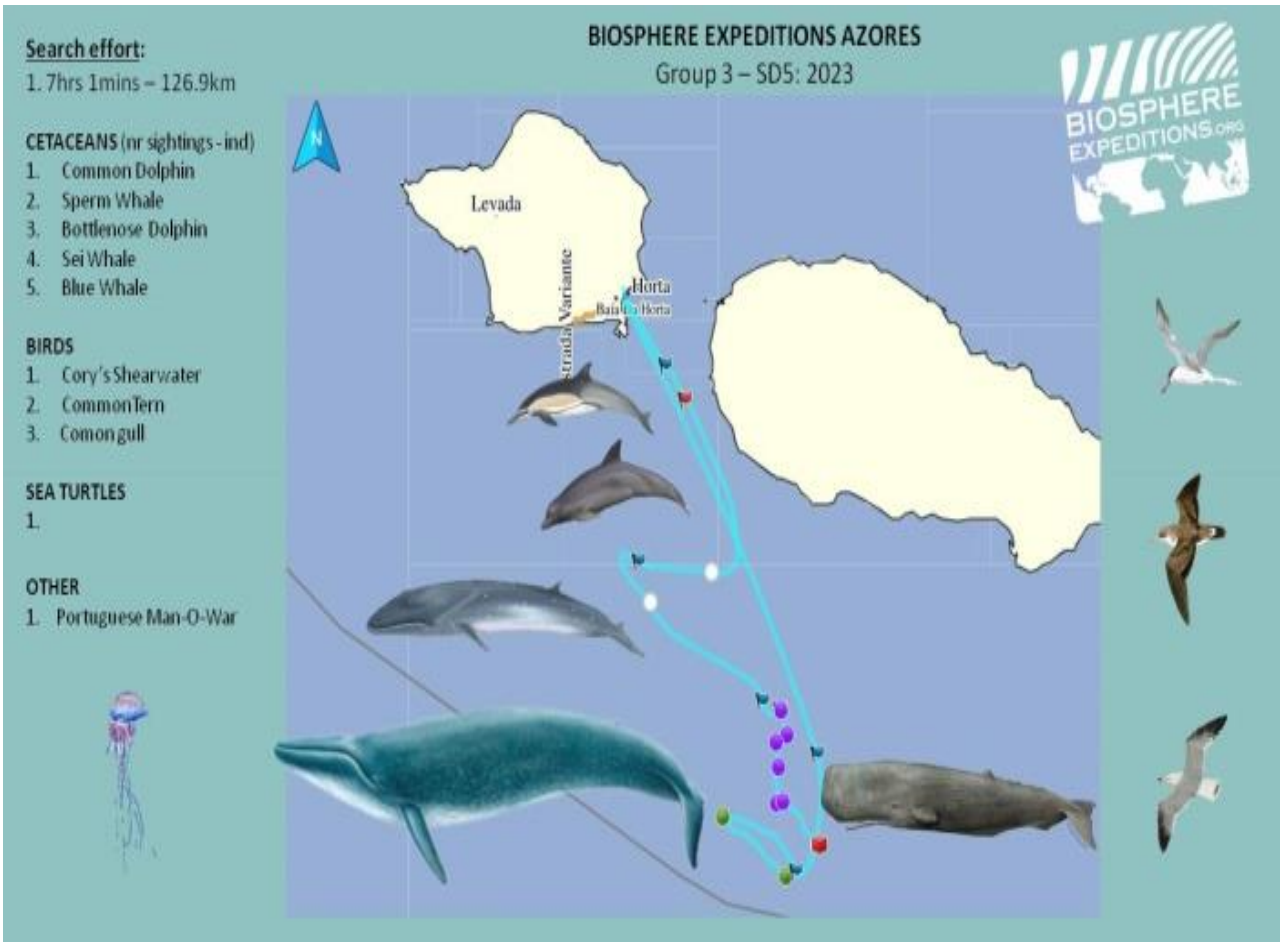


Figure 2.3x. Group 3 tracks and sightings (continued overleaf).

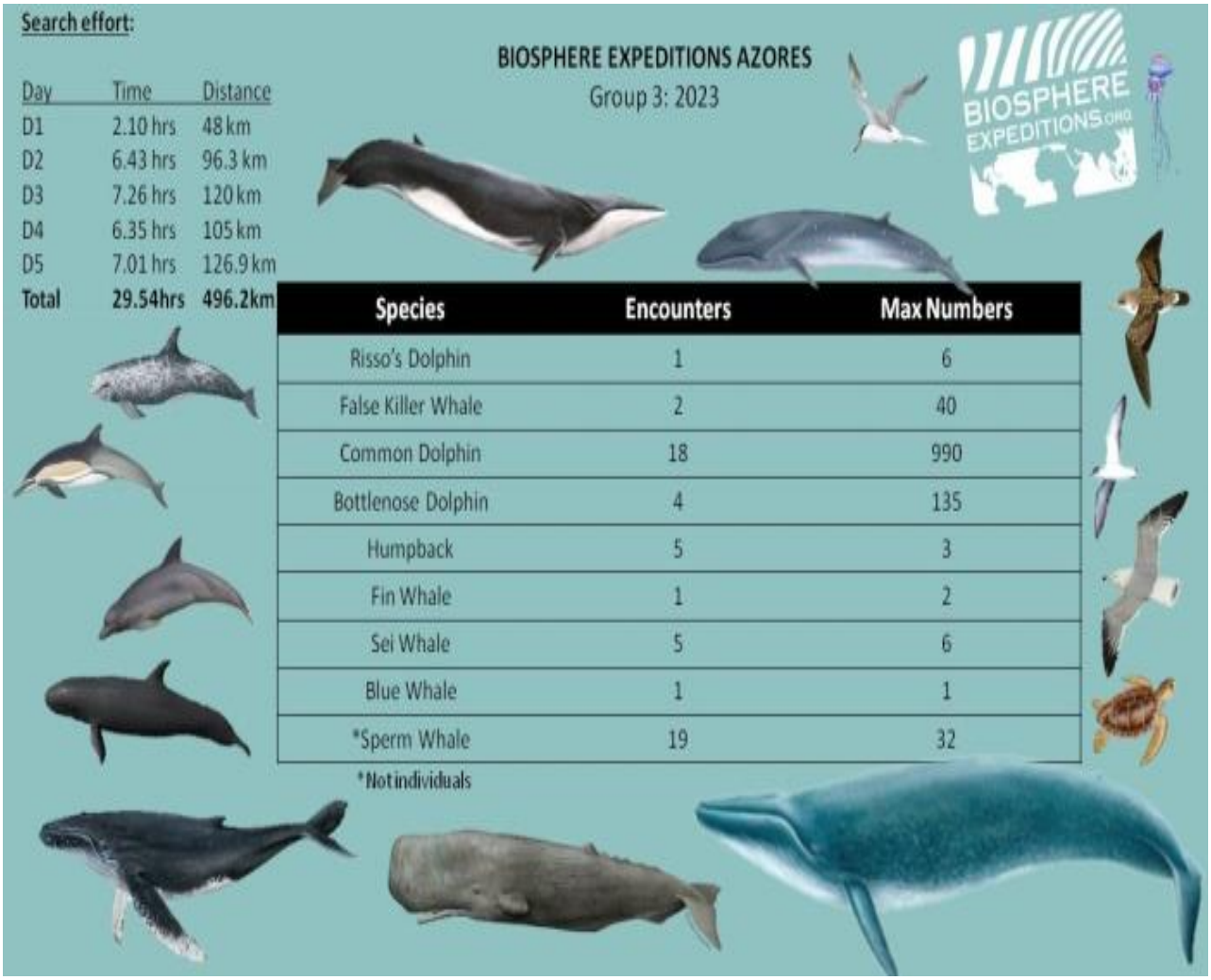


Figure 2.3x. Group 3 tracks and sightings.

Monicet app

The Monicet data collection app was again used on a smartphone. Monicet is a platform that collects cetacean sightings and tracks of boats, mainly from around the Azores. It is used by several whale watching companies (www.monicet.net). The tracks and sightings collected using the app during all three expedition groups are shown in Fig. 2.3y. The multi-coloured lines are the tracks from each day and the multi-coloured dots represent every sighting per day. The sighting information was sent directly to Monicet at the end of every trip.

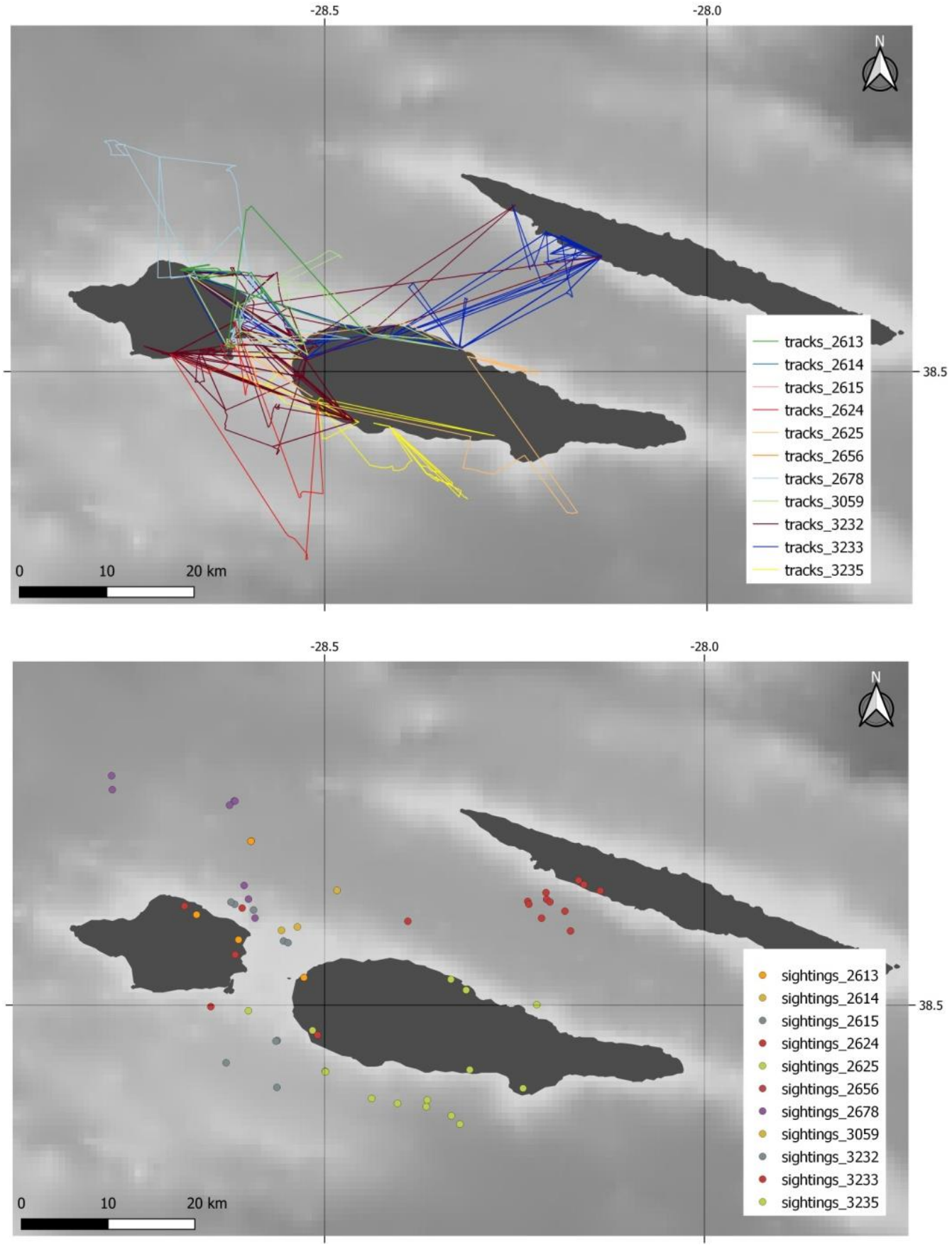


Figure 2.3y. Tracks and sightings for all three groups on Monicet app. Different colours represent different days.

2.4. Discussion & conclusions

2.4.1. Summary of expedition work and results 2004-2023

Over the past 20 years (2004-2023 with the exceptions of 2017, 2020 & 2021 when no expeditions took place), the expedition has spent 1720 hours at sea looking for cetaceans: 141.5 hours in March, 1096.7 in April and 483 in May. During that time the expedition has registered a very large number of animals (Fig. 2.4a shows the number of sightings for the main species seen, adjusted for effort).

Highlights of the expeditions over the years were:

- 572 new sperm whales were identified, as well as 213 re-sighted animals. During the 2007 expedition, a record 167 sperm whales were encountered (not all different individuals), with another five expeditions yielding over 100 sightings each.

- 132 separate blue whale sightings were made, with 7 individual blue whales being re-sighted in different years (not always during the expedition). To date, no blue whale identified during an expedition has been identified elsewhere.

- 204 fin whale encounters were recorded during the expedition since 2004. So far, no fin whales identified during the expedition have been identified elsewhere.

- 42 humpback whale sightings were made, with 2 individuals re-sighted in the Cape Verde Islands and 2 matched to Norway. In 2022, during the expedition, a leucistic individual (98% white) was matched to both Norway and the Caribbean. No other humpbacks sighted during an expedition have been matched to other areas of the Atlantic, although outside of the expedition, there are quite a few long-range matches.

- Thousands of dolphins have been recorded, and the expedition has been fortunate to observe some rare sightings, such as pygmy sperm whales, false killer whales, orcas and two species of beaked whales.

- Several loggerhead turtles have been caught and tagged during the expeditions, but none of them have been recaptured elsewhere.

- Since the expeditions began in 2004, the lead author has given presentations or presented posters at marine mammal conferences. An oral presentation at the European Cetacean Society (ECS) conference in Kolmarden was given in 2004 on site fidelity of sperm whales. She has also been first author on posters at three conferences and co-author on several others: In 2009, at the Society for Marine Mammalogy (SMM) in Quebec City, a poster was presented on male sperm whale matches from the Azores to Norway (Steiner et al. 2009), which has since been published (Steiner et al. 2012). In 2015 at the SMM in San Francisco, the topics were movements of female sperm whales between the Azores, Madeira and the Canaries (Steiner et al. 2015), the first blue whale matches from the Azores to Newfoundland and Norway (Sears et al. 2015) and humpback whales using the Azores as a stopover feeding point (Cucuzza et al. 2015). In 2016, a poster was presented at the ECS in Madeira on habitat use of species of baleen whale in the Azores (Chevallard et al. 2016). And in 2019, a poster was presented at the SMM in Barcelona about false killer whales in the Azores (Steiner et al. 2019). In 2022, there were 2

presentations at the 33rd ECS virtual conference: one on site fidelity and residency patterns of sperm whales (Ferreira et al 2022) and the other on connectivity of cetaceans in Macaronesia (Alves et al. 2022). In 2023, the lead author gave a talk at the Beyond Whale Watching Conference: “Photo-ID in the Azores, discovering connections around the North Atlantic”. The presentation presented the matches of various species from the Azores to the rest of the North Atlantic.

- Other papers published since the start of the expeditions and co-authored by Lisa Steiner have dealt with humpback whale sightings around the Cape Verde and North Atlantic (Wenzel et al. 2009). Matches of male sperm whales between the Azores and Norway were published in 2012 (Steiner et al 2012). Other publications comprise a paper on True’s beaked whales around the North Atlantic (Aguilar de Soto et al. 2017), movements of pilot whales between the Azores, Madeira and the Canaries (Alves et al. 2019), a paper on abundance of sperm whales in the Azores (Boys et al. 2019), a note about a match of a sperm whale between the Gulf of Mexico and the Azores (Mullin et al 2022) and a paper on site fidelity of sperm whales in Macaronesia (Ferreira et al. 2022). Most of these publications used data not collected during the expedition. Lisa Steiner is currently working on a paper about blue/fin whale hybrids with colleagues from Iceland, the Azores and Ireland (Iverson et al. in preparation). The paper on the male matches around the North Atlantic is going to be updated soon and a paper on the movements of female groups of sperm whales around Macaronesia is also planned as well as the social structure of sperm whale groups around the Azores.

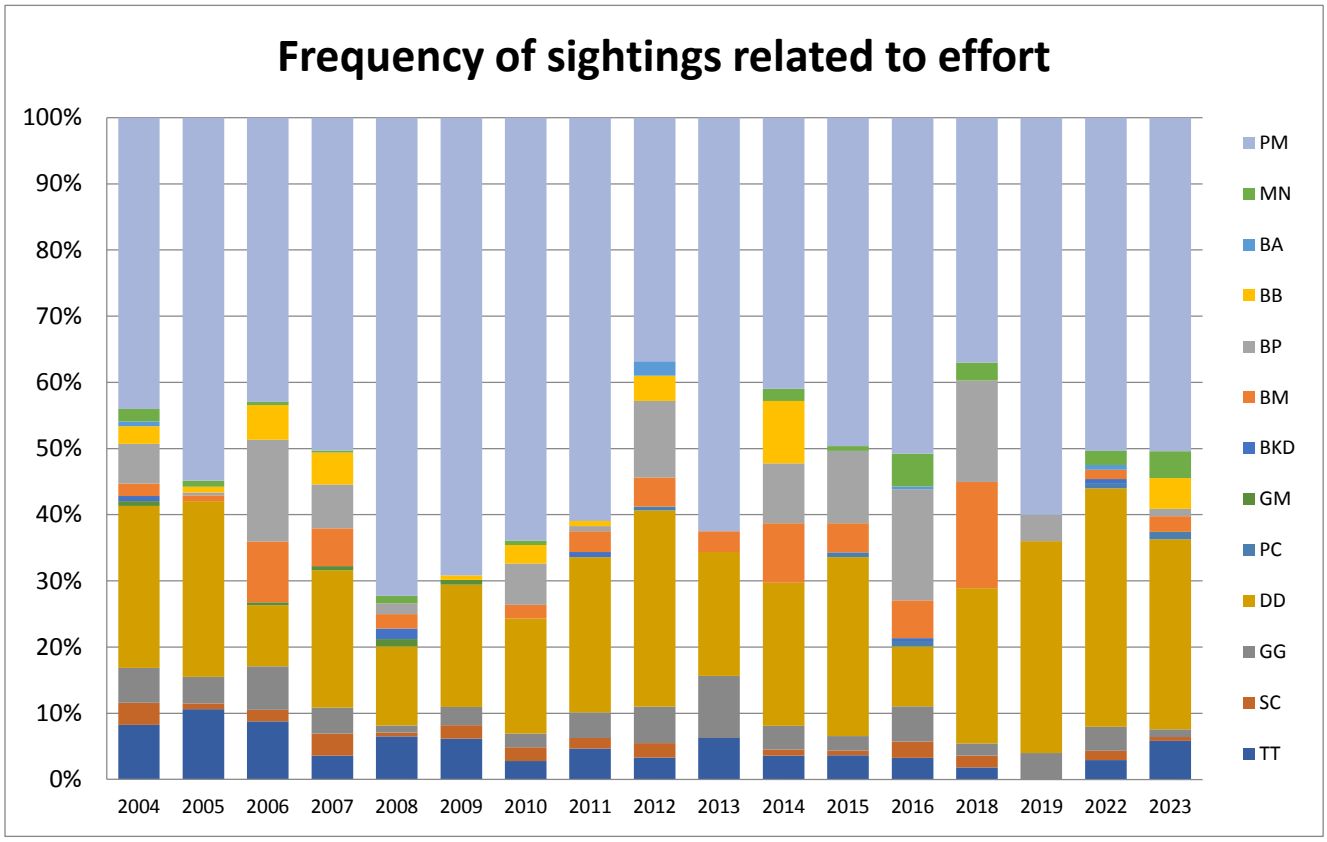


Figure 2.4a. Species sightings 2004-2023 adjusted for effort. PM = *Physeter macrocephalus* = sperm whale, MN = *Megaptera novaeangliae* = humpback whale, BA = *Balaenoptera acutorostrata = minke whale,* BB = *Baleanoptera borealis* = sei whale, BP = *Balaenoptera physalus* = fin whale, BM = *Balaenoptera musculus* = blue whale, BKD = *Mesoplodon/Ziphiidae* sp.= beaked whales, GM = *Globicephala* sp.= pilot whales, PC = Pseudorca crassidens = false killer whale, DD = *Delphinus delphis* = common dolphin, GG = *Grampus griseus* = Risso's dolphin, SC = *Stenella coeruleoalba* = striped dolphin, TT = *Tursiops truncatus = bottlenose dolphin,*

For the lead author it continues to be a source of great motivation and inspiration to watch expedition participants arrive with little or no experience and gel into a team that gets the work done, sometimes in very challenging conditions.

These highlights show how important the work of Biosphere Expeditions is to gathering information on the cetaceans around the Azores. Considering the short duration of the expedition in any given year, the fact that we have collected as many data as we have is a very significant achievement.

2.4.2. Expedition year 2023

March and April are usually a good time for cetacean sightings in the Azores. Biosphere Expeditions plays an important role by collecting vital information at a time of year when little or no research work has been done in the past, mainly due to low numbers of tourists and lack of independent funding. This trend is slowly changing, with more tourists coming to try and see the baleen whales passing on their migration in the spring.

Many species of cetacean can be observed in the archipelago. In fact, the variety of cetaceans is usually greater at this time of year than at any other time of the whale watching season. Sightings of baleen whales are unpredictable, but the use of lookouts (vigias) on the cliffs greatly enhances the probability of sighting them.

The weather in 2023 was good for most of our surveys. The expedition was at sea for over 93 hours over the three groups. Only a couple of days were in difficult conditions.

There were 21 encounters with four species of baleen whales during the expedition, which is average for the past few years. Sightings of baleen whales continued after the expedition, but is still below the record years of 2014-2016. This could possibly be explained by a lower primary productivity (plankton) in the area, which means that there is less food for the animals to eat, so they look elsewhere. The chlorophyll productivity in the North Atlantic is gradually increasing (Fig. 2.4b), but there can be local variations in where this productivity is located. 2014 had the most sightings of baleen whales in the Azores since records began (L. Steiner, unpublished data). After 2014, the productivity began to decrease in the Azores and appear further north (Sergi Perez Jorge pers. comm.) and this variation can be seen in Fig. 2.4c.

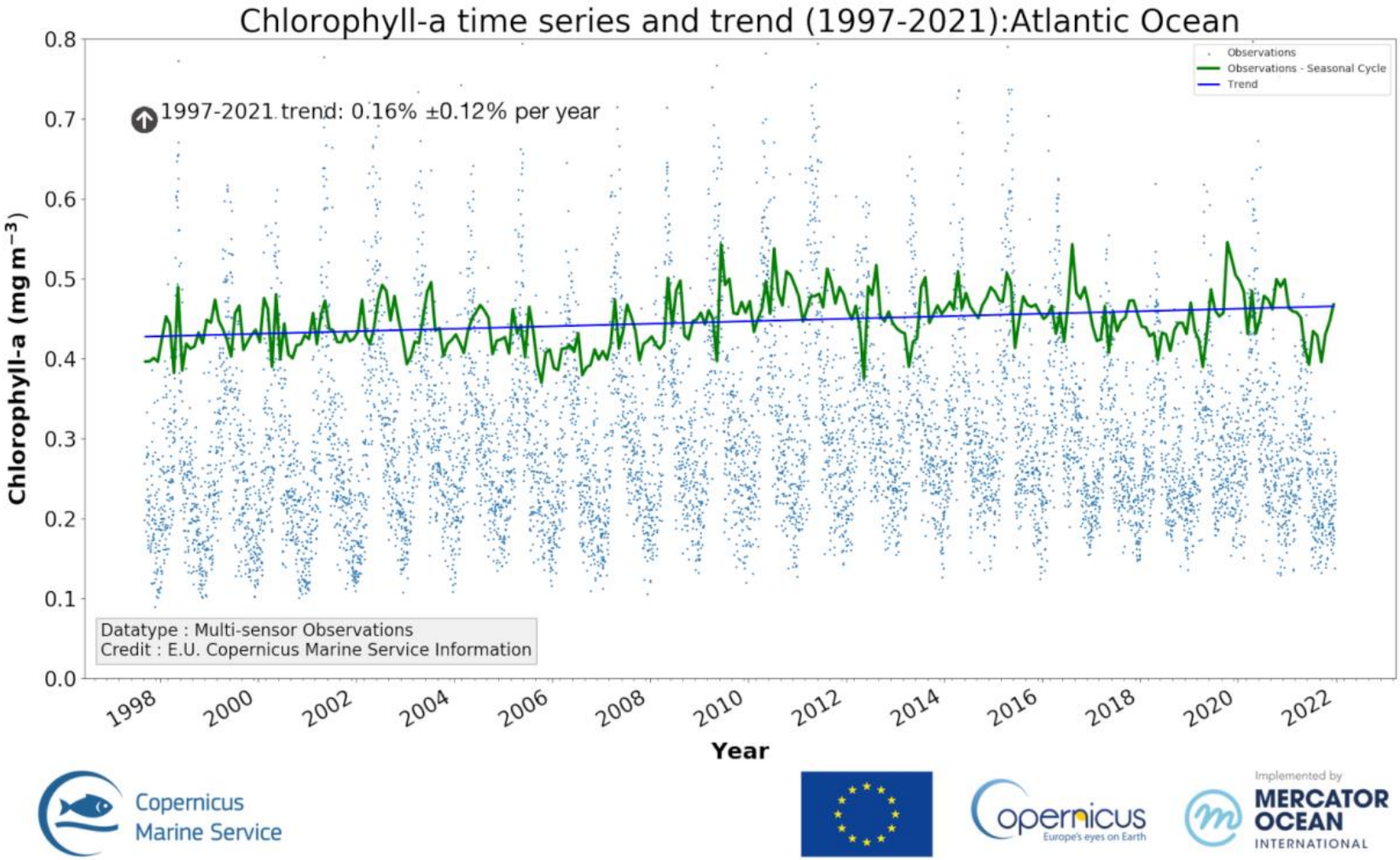


Figure 2.4b. North Atlantic chlorophyll 1997-2022.

Fig. 2.4c shows the concentration of Chlorophyll a, one of the indicators of productivity, on 7 April over the past three years (the mid-timepoint of the expedition), indicating that the expedition has been run at the time of highest productivity in the Azores. It is also clear that productivity has been higher to the west and north of the expedition study area for the last three years. Whales will generally be more abundant where the productivity is higher.

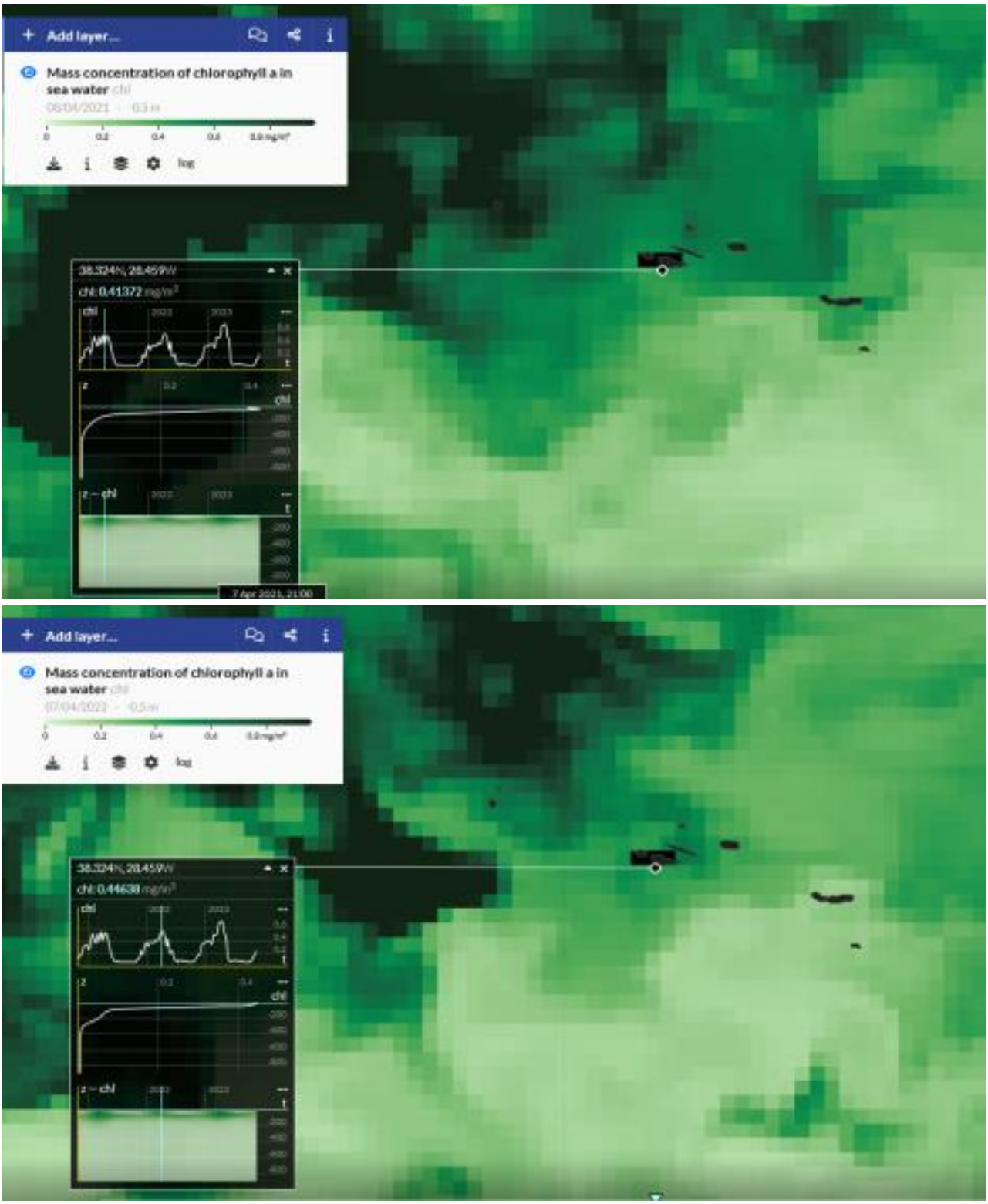


Figure 2.4c. Chlorophyll a on 7 April 2021, 2022 & 2023 (continued overleaf). The darker the colour, the higher density of Chlorophyll a. The Azores islands appear as dark spots, with the south of Pico marked by the white line and black dot.

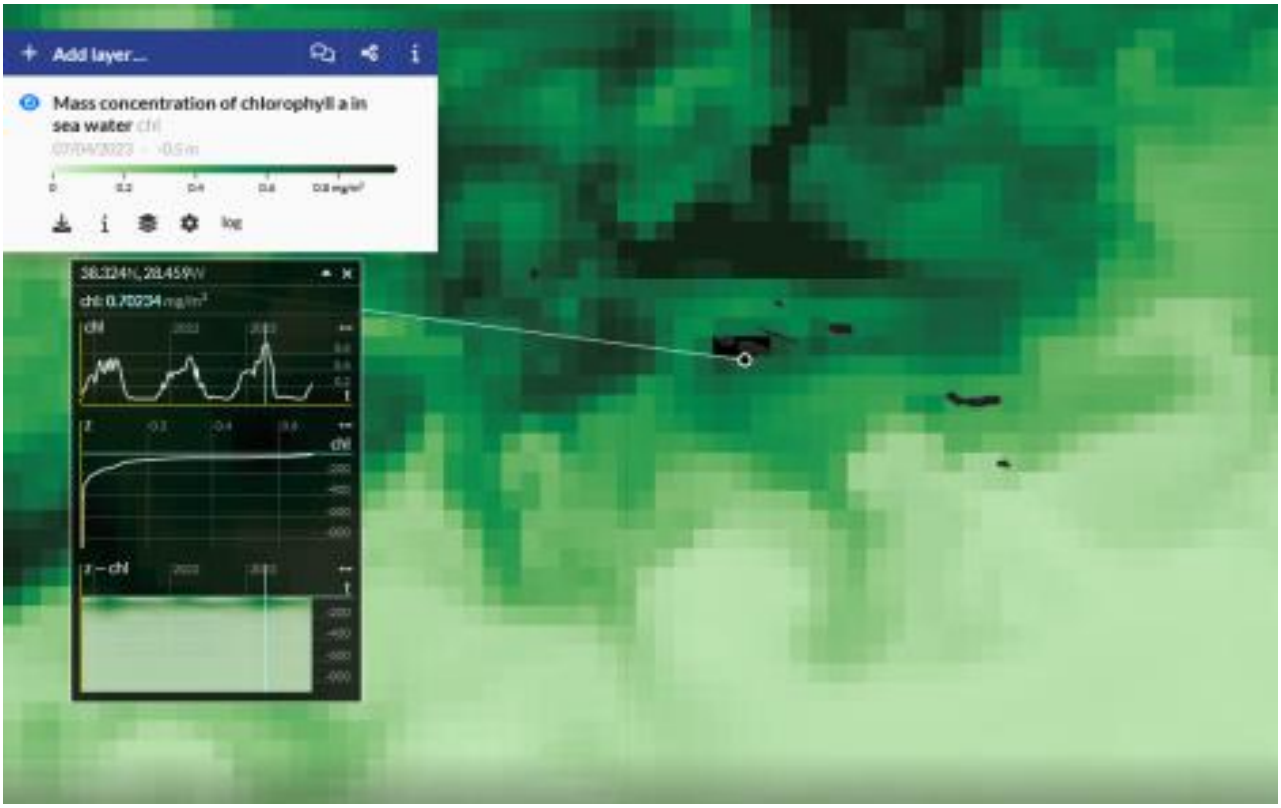


Figure 2.4c. Chlorophyll a on 7 April 2021, 2022 & 2023. The darker the colour, the higher density of Chlorophyll a. The Azores islands appear as dark spots, with the south of Pico marked by the white line and black dot.

Blue whales

Six blue whales were seen in four encounters. One group of three and a single blue were thought to be feeding, with non-random movement. The other two individuals were travelling NW, on their way to feeding grounds, most likely in either Norway or Iceland. Two individuals were seen previously in the Azores. As far as we know from tags placed on blue whales by the University of the Azores (Fig. 2.4d), their general movement is northwards in the spring, but the tags have stopped working or fallen off before the animals have reached their main feeding grounds (Silva et al 2013).

The Azores blue whale catalogue now contains around 500 individuals (not all the author's or expedition photos), making up the majority of the just over 800 individuals' strong Northeast Atlantic blue whale catalogue. The Northwest Atlantic blue whale catalogue, by comparison, comprises of 550 individuals. There are an estimated 2,000-3,000 blue whales in the North Atlantic. This number is still speculative, because reliable capture-recapture studies cannot be carried out with limited sightings (R. Sears pers. comm.).

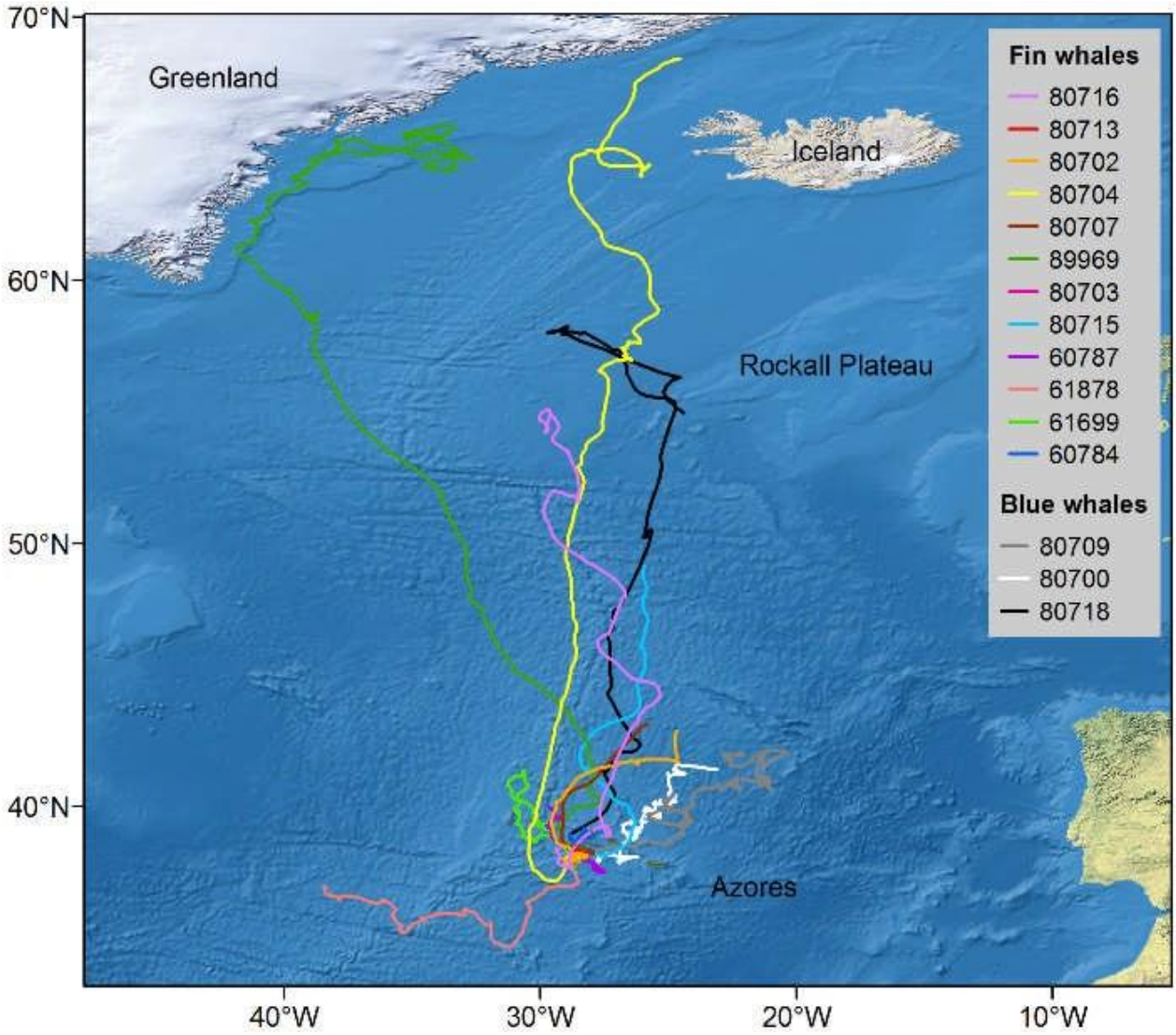


Figure 2.4d. Movement of blue and fin whales tagged in the Azores.

Within the North Atlantic, the rarity of matches (only two to date) between the East and West North Atlantic catalogues suggest that there are two largely discrete populations in the North Atlantic. One population appears to live between West Greenland south along the coast of North America, centred in Eastern Canadian waters. The other extends from the Denmark Strait, Iceland and Jan Mayen, Spitzbergen, to the Barents Sea in the summer, and South to the Northwest African coast in the winter (Sears et al. 2015). Recent matches of blue whales to Ireland and Galicia, Spain are also in line with the more common matches to Norway (Fig. 2.4e). These are also supported by the genetic structure of blue whales across the Atlantic (Oosting et al. 2013). The tags put on blue (and fin) whales by the University of the Azores corroborate evidence for blue whale northward routes from the Azores that stay within the East North Atlantic population/catalogue (Fig. 2.4d).

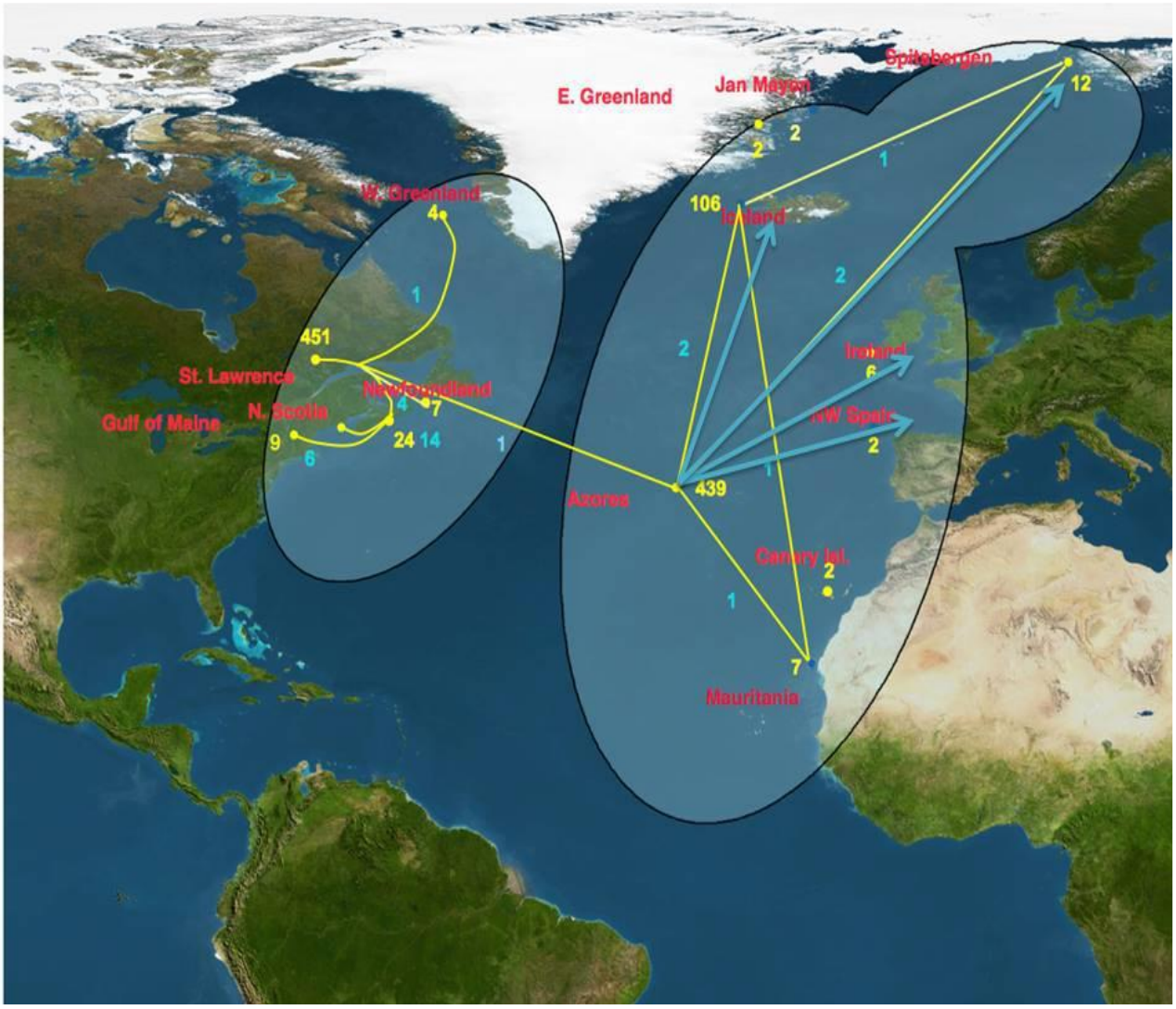


Figure 2.4e. Blue whale movements in the North Atlantic (from Sears et al. 2015).

One of the trans-Atlantic matches occurred in 2014. After the expedition, a blue whale was seen off the south coast of Pico that had previously been seen in the Gulf of St. Lawrence, Canada in 1984, 30 years previously. Its whereabouts over the last 30 years remain a mystery, demonstrating (1) that there may be limited mixing between East and West North Atlantic populations/catalogues, and (2) the need for continuous photo ID collection to elucidate whale movements and population boundaries (Sears et al. 2015). Elucidating such movements and population locations and boundaries is important, because blue whale populations do not seem to be recovering from population crashes at the same rate as other whales, making route determination with a view to establishing effective protected areas doubly important.

The fact that some blue whales are seen in multiple years shows that some individuals may have a preference for their migration route.

Fin whales

Over the past few years, the number of fin whale sightings has been lower than other baleen whales. They may be migrating past the islands further offshore to correspond with the higher productivity there. In the past, fin whales tagged by the University of the Azores moved in a generally northerly direction (Fig. 2.4d). There has been one match of a fin whale from the Azores to Northern Spain (L. Steiner/B. Diaz unpublished data), but no other region to date. With fin whaling set to return to Iceland in 2025, it is important to find out where the fin whales passing through the Azores are going.

Sei whales

Sei whales were only discovered in the Azores in the late 1980s (Gordon et al 1990). The expedition in 2023 had several sightings of sei whales. Sei whales often pass by the islands shortly after other baleen whales and may feed more opportunistically than other baleen whale species. There was an unprecedented influx of sei whales (10-20 daily) to the south of Faial and Pico between August and October 2022, feeding on needlefish (L. Steiner unpublished data). All of the sei whales tagged by the University of the Azores headed towards Labrador, Fig. 2.4f (Olsen et al. 2009, Prieto et al. 2010). The behaviour recorded during the expedition, travelling to the W or NW on most occasions, supports this finding.

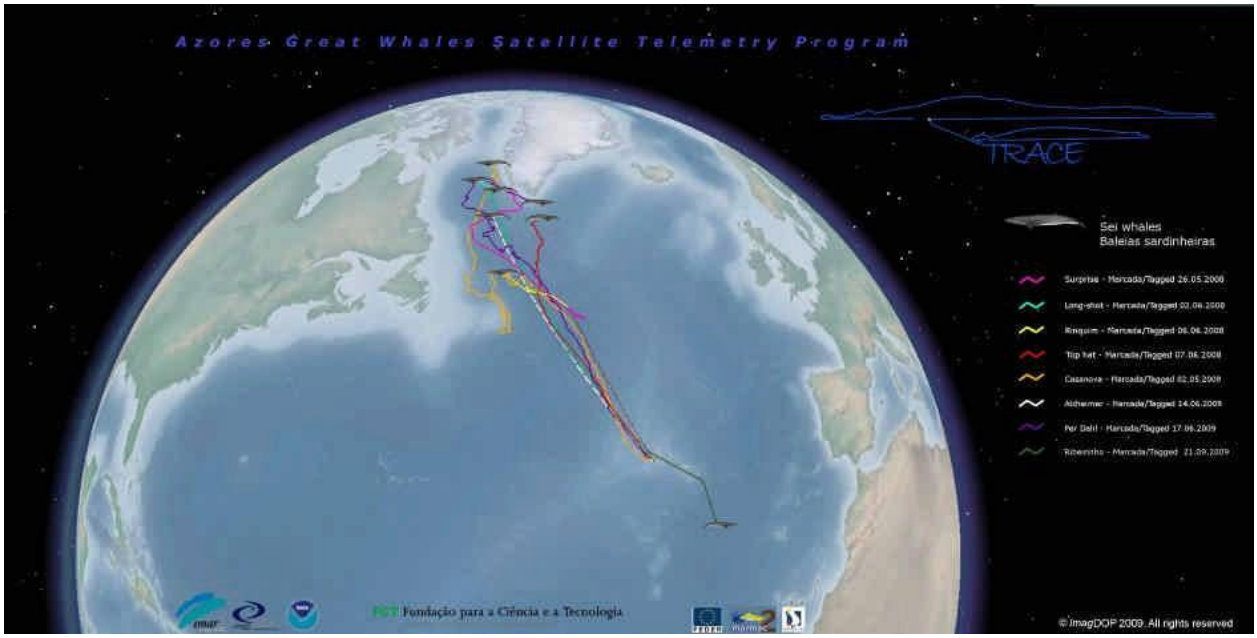


Figure 2.4f. Movements of tagged sei whales from the Azores to Labrador.

Humpback whales

Three humpbacks were seen over seven encounters, one whale sighted on three separate days. If humpback whales find food on their way back to the main feeding areas in Iceland or Norway, they will stop as long as the food lasts. In all sightings, the whales were feeding, except for the first encounter, where it was thought they were feeding on horse mackerel, as no bait fish were seen. Fluke photos were taken to identify individual animals, but no matches were found to other regions. The photos remain in the North Atlantic Humpback Whale Catalogue as well as the online matching platform, Happywhale www.happywhale.com, so they can be matched in the future.

With the expedition now starting earlier in the season, it is possible that some individuals observed are on their way to their breeding grounds, instead of on their way north to the feeding grounds. These individuals can be recognised by the yellow diatoms (algae) on the flukes. These are only present on individuals that have recently been in the colder regions of the feeding grounds and are usually absent on animals in or returning from the warmer waters of the breeding grounds, because the algae need the cold water to survive (F. Broms, pers. comm.).

Figure 2.4g. Second Azores to Newfoundland match.

In wider research on this species outside the expedition, there have been several humpback whales sighted in the Azores that have also been seen in the Cape Verde Islands (Wenzel et al. 2009). To date there are 21 matches between the Azores and Cape Verde (not all the author's or expedition photos) with five of those being seen in northern Norway (Fred Wenzel, pers. comm.) and another nine matched to Norway (Fred Broms, pers. comm.). One humpback whale sighted during a previous expedition was recently matched to a whale seen in northern Norway (2014/2015) and close to the Russian border (2016) (unpublished data). There has been a new match from the Azores to Newfoundland, which is the second trans-Atlantic match (unpublished data, Fig. 2.4g). Both photos were taken in 2008, but the image from Newfoundland was only recently uploaded, demonstrating the value of catalogues and collaboration.

Tagged humpbacks have passed by the Azores on their way to the Caribbean (unpublished data), but it was not until 2021 that the first fluke match was made. Two animals tagged in Norway in 2017 came close to Faial on their way to the Caribbean (unpublished data), just not close enough to be identified. There are now five fluke matches (not all the author's photos) from the Azores to the Caribbean, (L. Bouveret, pers. comm.). Two new matches have also been made recently from the Azores catalogue to Iceland (N. Oria, pers. comm.) using Happywhale. A new publication is in preparation about the movements of humpbacks from feeding to breeding grounds (F. Wenzel, pers. comm.). Although this particular paper is not going to focus on individuals seen in the Azores, the paper by Wenzel et al. (2009) should be updated in the near future.

The North Atlantic Humpback Whale Catalogue, managed by the College of the Atlantic, currently has over 11,000 individuals on record and although the Azores photos are a very small part of this catalogue, they play an important role in discovering some long-range matches. Since 2004, the expedition has contributed 28 ID photos to the catalogue, which produced two matches to the Cape Verde Islands in 2010, one in 2018 and one to Norway in 2018, and two matches in 2022: one to Norway and the leucistic individual to both Norway and Guadalupe (unpublished data). Although there were no long-range matches in 2023, the images remain in the catalogue for future matching. The Cape Verde match made during the expedition, as well as data collected outside the expedition and by Wenzel et al. (2009), suggest that most of the humpbacks that are seen in the Azores are part of the endangered Cape Verde population, rather than the Caribbean population, which was taken off the endangered list in 2016 (Fig. 2.4h, Wenzel et al. 2009). Matching movements and populations is important, because little is known about the movements of the eastern Atlantic humpback whales and as an endangered population, it is good to monitor its status in order to take action as soon as possible if a decline is noticed. Some animals appear to stop in the Azores to feed on their way to the final feeding grounds as well as on their way back to the breeding grounds (Cucuzza et al. 2015). With several matches made to Norway, it would appear that many of the Cape Verde animals make their way to Norway as a preferred feeding area (Wenzel et al. 2009). This project has made a significant contribution to these important insights.

Two collaborative projects were conducted with the University of the Azores, looking at sightings of (non-baleen) sperm whales (Boys et al. 2016, 2019), as well as baleen whales, with respect to environmental data collected by the university (depth, slope and tide as a few examples). One poster on baleen whales, using photo-ID from 1998-2015, was presented at the 2016 ECS conference in Madeira. This corroborated the results mentioned above, i.e. that some blue whales have been seen in multiple years, fin whales only rarely, and only one sei whale to date has been seen in multiple years, although more matching may produce some more sei whale matches. Some individual blue and fin whales remain in the Archipelago for a few weeks during the spring feeding, while the sei whales generally do not (Chevallard et al. 2016). However, in the summer of 2022, an unusual event occurred. Instead of observing a few sei whale individuals migrating through the islands during the summer, dozens of sei whales were observed feeding on abundant baitfish to the south of Faial and Pico for three months (Aug-Oct). At the moment, it is unclear whether the same individuals remained in the area or if different animals were passing through and taking advantage of the ample food supply (L. Steiner unpublished data).

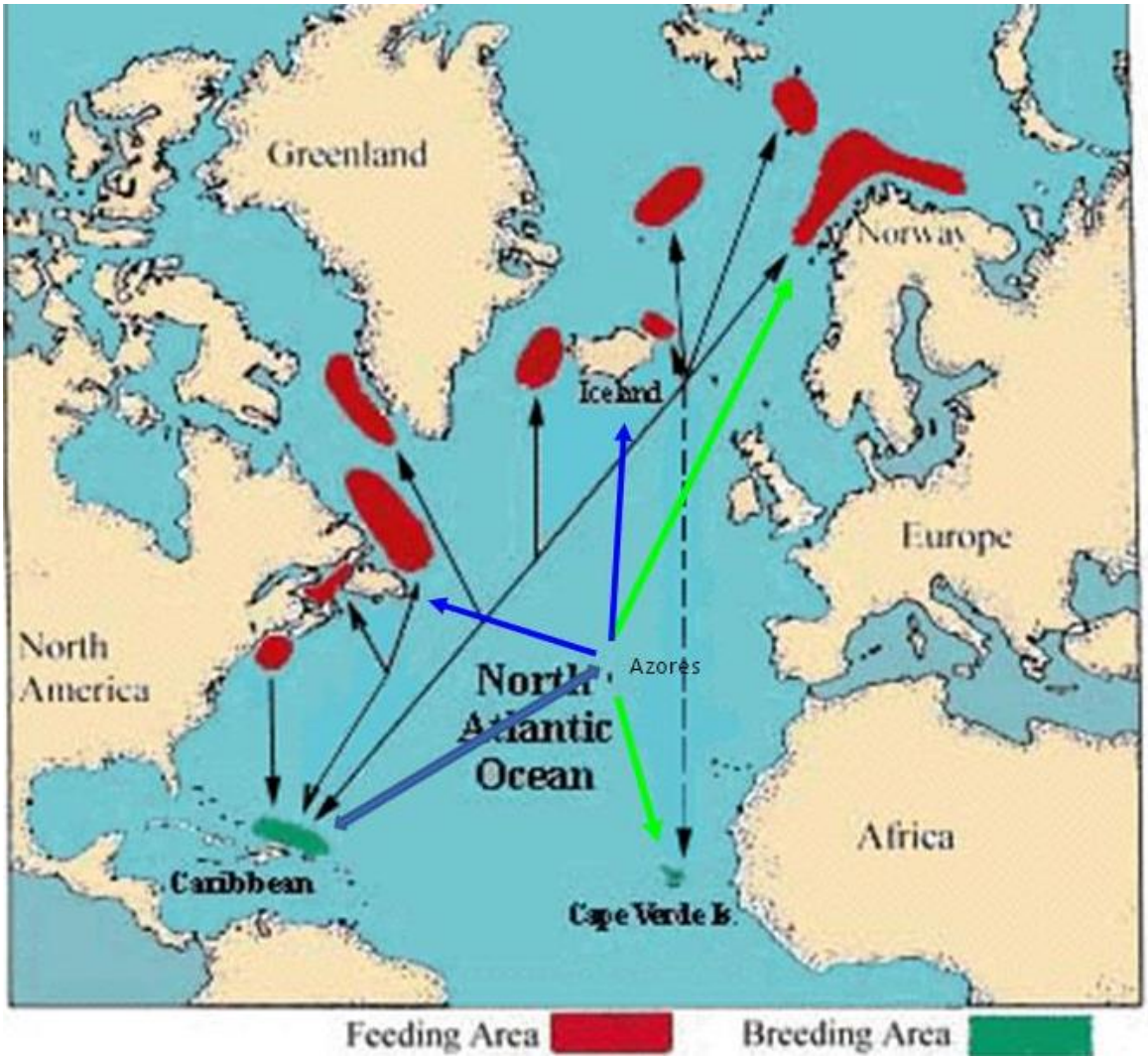


Figure 2.4h. Movement of humpbacks in the North Atlantic. Azores matches in green and blue.

The significance for whale conservation and research of these findings is that they suggest that the Azores provide a crucial 'pit stop' (between breeding grounds further south, possibly Mauritania, Cape Verde and the Caribbean, and feeding grounds in Iceland and Norway) for some of the migrating animals that do not feed for a few months on the breeding grounds. The resources that they find in the Azores could make the difference between survival and death. Having a baseline of information on the number of animals and the areas that they are using may also be useful in detecting any early changes in prey abundance due to global warming. Only over the next few years will we be able to determine if this slowdown in productivity around the Azores is a normal variation in productivity, or an indication of future trends due to global warming.

Most researchers will not risk coming to the Azores to find baleen whales, because their migration patterns are too unpredictable, as can be seen by the expedition's very variable success in recording baleen whales. Researchers could come to the islands for a few months and not find a single baleen whale. The expedition has the luxury of already being in place and with the vigia (lookout) network, if the animals are present, can take advantage of any opportunities that present themselves.

Researchers responsible for the baleen whale catalogues are always thankful for data gathered during the expedition, and continue to communicate repeatedly to the author the importance of the baleen whale photos taken during the expedition, since the Azores may be a route marker for animals travelling North (R. Sears, L. Jones, F. Broms pers. comm.).

Dolphin species

Overall, dolphin sightings were good. Common dolphin were seen on most days. There were not many bait balls and feeding frenzies with Cory's shearwaters observed during the expedition, apart from the first humpback sighting and once with common dolphin. The last few years have had lower overall dolphin variety during the expedition (and beyond) than previous years. To date, it is not known why; although, if there is lower primary productivity, then it follows that there will be less prey for some species to eat. One factor is also the amount of time that is spent with whales. When we are with target species of whales, we stay in one general area and are not actively looking for dolphin, which could skew results.

Another possibility is that the dolphins have been stressed by swimming with dolphin boats. Although that activity occurs mainly in the summer months, dolphins may now spend less time in the main whale watching areas or even actively avoid the boats. There are a couple of studies that suggest common dolphin and Risso's dolphin avoid boats that carry passengers who will attempt to swim with them (Cecchetti et al 2018, Visser et al. 2011). There are currently no other studies on the impact of swimming with dolphin on other species in the Azores.

Common dolphin

Forty-nine groups of common dolphin were seen. These dolphins are not part of the photo-ID project, since group sizes can often be quite large, making it difficult to identify all the individuals and prior to digital photography, prohibitively expensive. The average group size was a bit small, at just under 30, but this result was likely due to the relatively high number of very small groups (≤10 individuals) that were seen. Over 50% of the groups were estimated to have ten or fewer individuals. This group size is also smaller than seen during the summer. If the food is spread out over a wider area, most likely the groups are smaller and spread out to find it and we possibly missed some animals, when we were heading to a target species and did not remain with the dolphin very long. Feeding was seen on three occasions, although it was not determined what species they were eating. Most groups were not very interested in the boat with bowriding only recorded in 30% of sightings.

Bottlenose dolphin

Bottlenose dolphin are one of the resident species of dolphin that can be seen in the Azores all year around (Silva, M. 2007). They were encountered ten times, with calves in 70% of the groups. The average group size of just under 30 is the same as we see throughout the year except when a few groups joined up for mating (unpublished data). Photo-ID showed some of our regular "residents" as well as a new very well marked individual that had not been seen previously in the central group. The marks did not look new and would have been noticed last year if they had been present. These nicks may have been caused by an interaction with the long-line fishery here, as they look similar to those seen on false killer whales interacting with fisheries in Hawaii (Fig. 2.4i, Baird et al. 2005,2014).

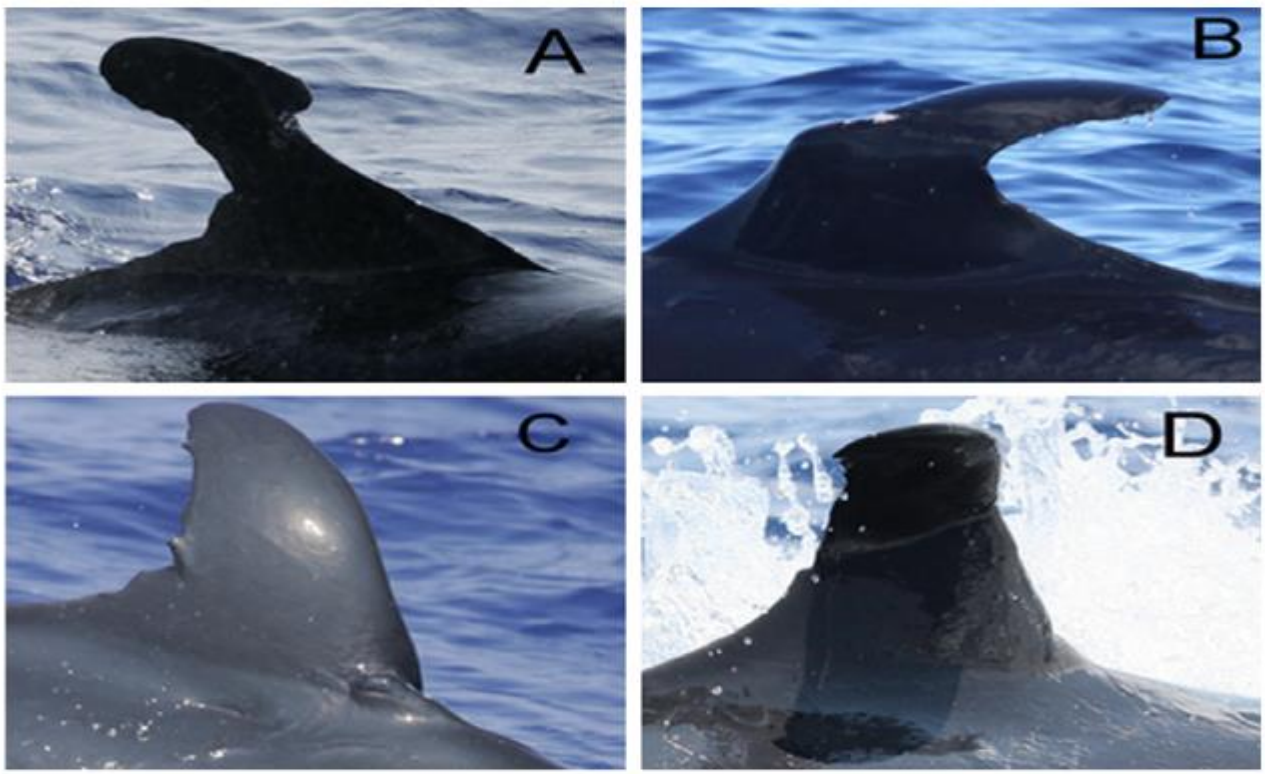


Figure 2.4i. Dorsal fin of bottlenose dolphin in comparison to false killer whales that have interacted with long-line fisheries in Hawaii.

Risso's dolphin

The expedition saw two groups of Risso's dolphin. They were both groups of males. Male Risso's dolphin tend to live in separate groups and usually only associate with females for breeding (Hartman et al. 2009). The males that were seen are the ones usually observed around Faial and only occasionally seen to the South of Pico where Karin Hartman, a local Risso's dolphin expert (Hartman 2014, 2018), works, so are not very well known (Hartman pers. comm.). All of the 2023 ID photos were forwarded to Karin Hartmann, for future analysis. She has also recently published a paper on the alliances of male Risso's dolphin, using drone footage (Hartman et al. 2020). During our brief encounter, the animals were not surfacing in pairs or groups, rather swimming individually.

False killer whales

This species was observed twice, although there was probably only one group spread out over a few kms, which is typical for false killer whales (Baird et al. 2008, 2010). The main group had an estimated 40 individuals of which we saw one individual 20 minutes before finding the main group. They were travelling to start with and then began to feed on tuna or possibly mahi mahi. There were also Cory's shearwaters following the group. After the feeding finished, the group began to socialise, with several leaps seen. Photo-ID work has only recently started on this species, trying to work out if it is resident. There are matches of individuals over long periods of time and also between islands, so it appears that they may be "resident" over the archipelago, rather than one specific island group (Steiner et al 2019). Dorsal fin ID photos were taken and after preliminary analysis several known individuals were identified. To date several individuals are known: AZPcA17 seen since 2005, AZPcB4 seen since 2007, AZPcA11 and AZPcA009 seen since 2009. This information supports the "resident" species hypothesis, although they are resident throughout the archipelago, rather than in one specific area. After the expedition, false killer whales continued to be observed, probably because there was plenty of tuna around this year. In the future we will attempt to match our catalogue to images from Madeira and The Canaries to see how wide ranging they may be.

Striped dolphin

Striped dolphin were encountered once during the expedition. In the Azores, this species tends to avoid boats. When groups of striped dolphin are seen, if the boat goes faster, the dolphins go faster, often jumping in the carousel formation. Sometimes when the boat slows down, the dolphins become calmer and occasionally even bowride. It is unknown why this is the case in the Azores, because in other areas, like the Mediterranean, the striped dolphin will bowride.

Sperm whales

The 2023 expedition had a total of 87 encounters of 46 identifiable sperm whales, including females with suckling calves, as was observed during previous expeditions, in addition to five big males.

“1822” was the oldest match, dating back to 1996, but had not been seen since 2009. “2488” first seen in 2002 and “2822” from 2004 were also seen. Four other individuals date back to 2010 and 2 of them, “3950” and “3953” have been seen together in multiple years. Sperm whale females tend to stay in the same group for their whole lives and our photo-ID agrees with that finding (Whitehead 2003).

Before Biosphere Expeditions began working in the Azores, the expectation was that we would see mainly large males in spring, but year after year, this has proven not to be the case, although we do tend to see more males in the spring than in the summer. Five males were seen during this expedition. It is normal for very large males to become more solitary the older they get. After they leave their natal group, at around 15 years old, they usually associate with other male “teenagers” in bachelor groups (Whitehead 2003). When mature - 25 years or more - they move around the north Atlantic (in this case) looking for females that are ready to breed (Whitehead 2003).

Re-sightings of male sperm whales in the Azores are rare, because they do not spend much time in one area. Rather, they move around looking for female groups to breed with when not in their feeding areas, which tend to be further north than the Azores (Whitehead 2003). It is not known how often mature males leave the feeding grounds to look for females to breed (Whitehead 2003). There have only been a few re-sighted males in the Azores over 30 years (unpublished data).

A few years ago, a match was made of a sperm whale seen in the Gulf of Mexico in 2002 which was re-sighted in the Central Group of the Azores in 2017 and another that had been seen in the Bahamas in 2005, which matched to São Miguel in 2017 (Fig. 2.4j). These are the first cross-Atlantic photo-ID matches of sperm whales (Mullin et al 2022). Little is known about movements of young males (Whitehead 2003). This whale had not been identified as a male in the Gulf of Mexico, but was positively identified as one 15 years later. So far there have been no more trans-Atlantic matches.

In October 2009, the author presented a poster on the movements of male sperm whales around the Atlantic at the Marine Mammal Conference in Quebec (with assistance from the Friends of Biosphere Expeditions), which was subsequently published (Steiner et al. 2012). Three males seen in the Azores were matched to animals re-sighted in Norway in 2007 and 2008. This gave researchers the first indication of where the males observed by the expedition may go when they are not in the Azores. The collaboration with biologists working in Norway is ongoing, but the males from this year’s expedition did not match. Since the first work in 2009, another 33 males have been matched between Norway and the Azores (unpublished data) and there are plans to update the 2012 paper. There are also new matches from Newfoundland to the Bahamas and Iceland to Dominica (unpublished data) which will also be included in the update. In 2019, a male sperm whale was tagged in the Davis Strait and followed for just over two months, until near Bermuda, when the tag stopped transmitting (Lefort et al 2022).

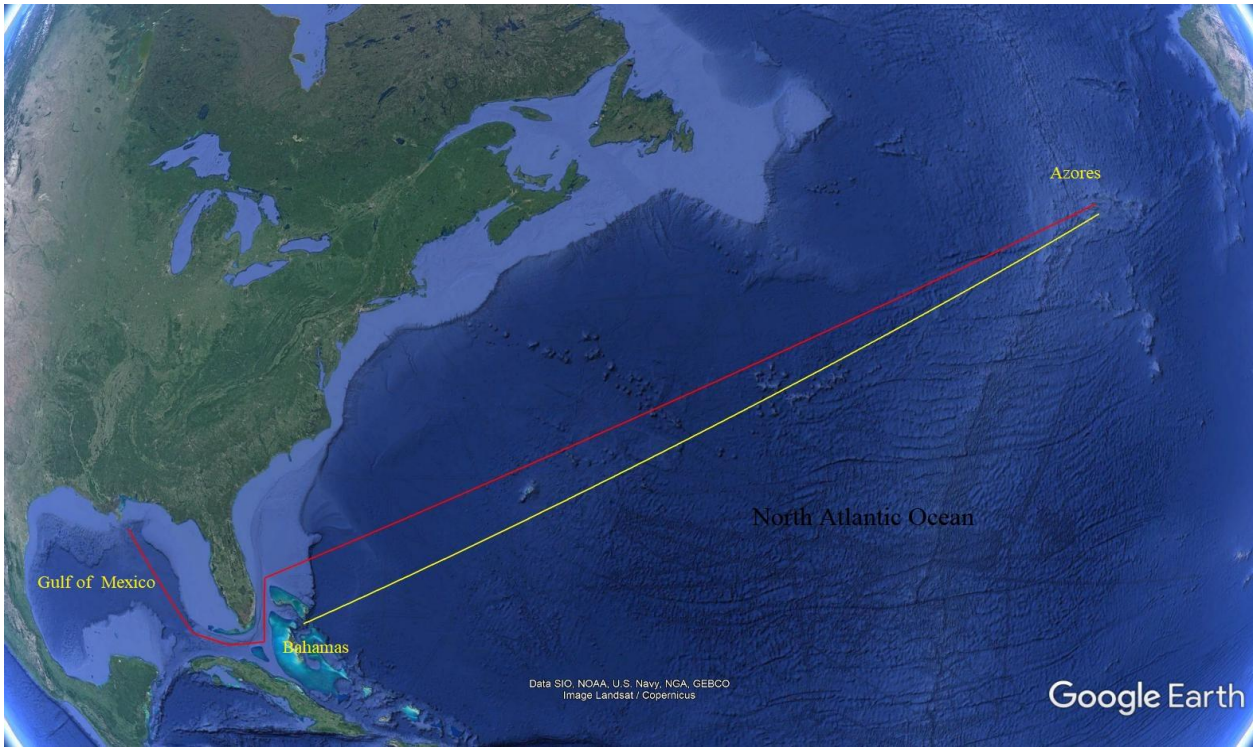


Figure 2.4j. Transatlantic sperm whale matches, using photo-ID.

In addition to co-operating with colleagues working on male sperm whales, the lead author has been collaborating with whale watching companies from São Miguel, as well as Pico, since 2010. Several matches exist between the islands, indicating that there is movement of some animals around the archipelago, although most animals have been observed in only one area (unpublished data). The two groups of islands (Pico/Faial & São Miguel) are only 125 nautical miles apart, so it is not surprising that there is movement between the two areas. Collaboration between the expedition scientist with labs in Madeira and the Canaries has been going since 1998. The Whale Museum of Madeira (www.museudabaleia.org) and more recently the Oceanic Observatory of Madeira (www.oom.arditi.pt), as well as SECAC (Sociedade para el Estudio de los Cetaceos en el Archipelago Canario, www.cetaceos.org) and CEAMAR (Cetaceans and Marine Research Institute of the Canary Islands www.ceamar.org) from the Canaries, share sperm whale photos to investigate matches within Macaronesia. This collaboration has already provided 32 matches for females between the areas (21 Azores-Canaries, 10 Azores-Madeira, 11 Madeira-Canaries). A few of the animals that have been sighted in the Azores and then in Madeira or the Canary Islands have returned to the Azores. This shows that at least some female sperm whales undertake a limited migration. All photo-ID sperm whale links, or satellite tracked individuals, males and females are shown in Fig. 2.4k.

An interesting development is that DNA samples that have been taken from sperm whales in the three archipelagos show distinct differences in DNA, indicating that the populations are separate (Rodrigues et al. 2019), thereby contradicting the photo-ID data. Collaboration will continue with other researchers to understand this phenomenon. This difference probably comes down to sample size. There were not many samples taken for DNA analysis and there are not that many groups that have moved between the archipelagos to date, so it is possible that there are some groups that tend to “roam” around the mid-Atlantic looking for food, while others are more resident in a particular archipelago.

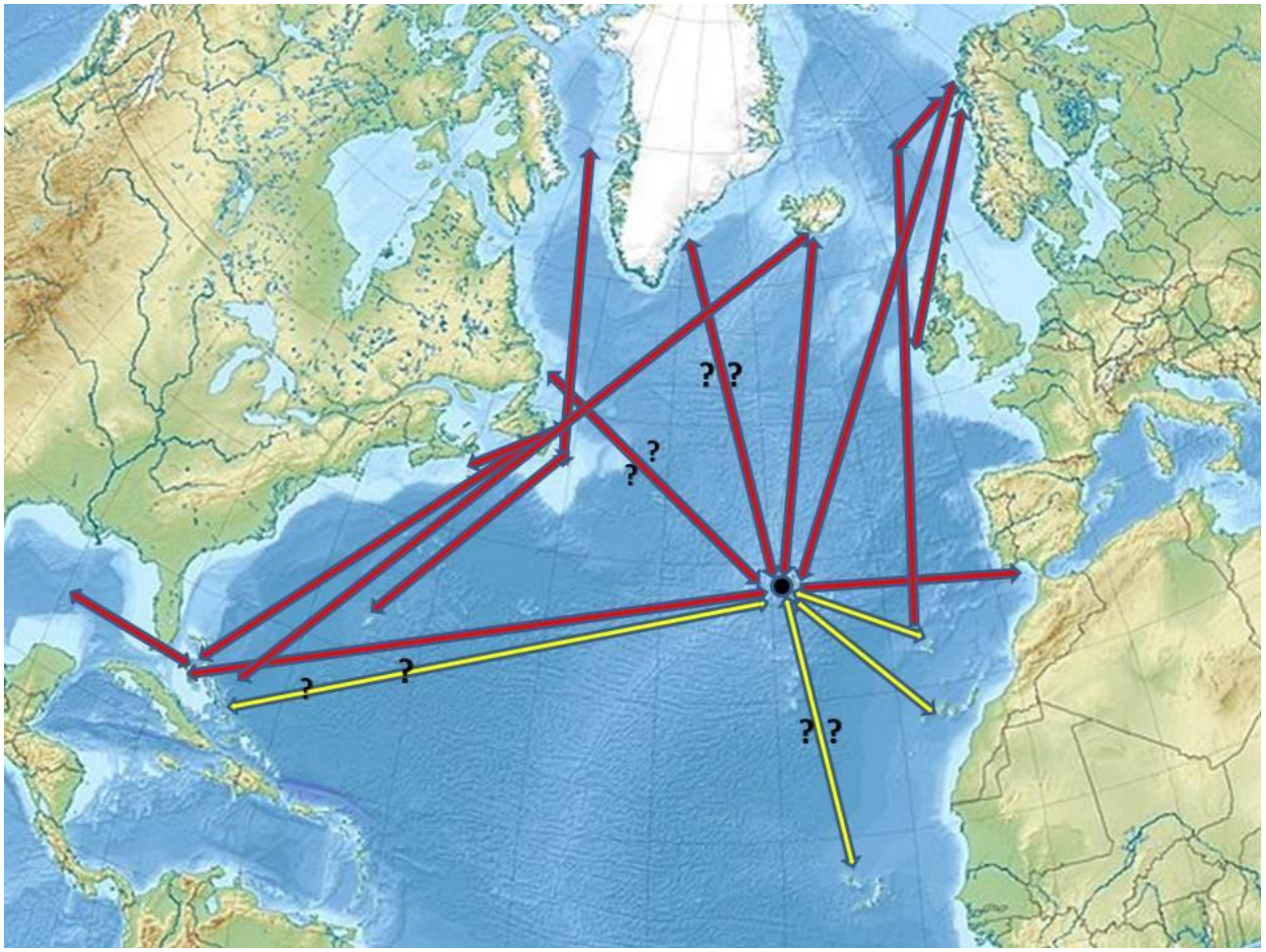


Figure 2.4k. North Atlantic sperm whale matches. Males in red, females in yellow. ? = unconfirmed routes.

Seeing re-sighted animals this early in the season shows that some of the sperm whales that return to the area do not have a seasonal preference and can be seen in all months, or they possibly move around the archipelago all year round. ID photographs confirm that female sperm whales spend their whole lives together (Whitehead 2003); it is the juvenile males that leave the group (Whitehead 2003). Some of the animals observed in previous years have been seen together for 28 years. Usually when one animal from a group has been seen before, the rest of the animals in the group have also been seen. Sometimes it is not possible to identify all the animals of a group on a given day, but repeated sightings of the same group over time give more chances to catalogue all of the individuals from that group. Sperm whales live for around 60-70 years, so some of these animals re-sighted in the Azores have been recorded for almost half of their lives. “1822” was an adult in 1996 when first seen, so in 2023, she is at least 37 years old.

In 2009 a PhD thesis by Ricardo Antunes was completed at St. Andrews University (Antunes 2009), using the Azores photo-ID database of individuals from 1987 to 2007. This was used to analyse the social structure of sperm whale groups found in the Azores, looking at long-term relationships between individuals and patterns of residency around the archipelago. He showed that there are differences between the groups of sperm whales observed here to those in the Pacific.

The groups of animals we observe in the Azores are more stable and associations between individuals last for much longer than they do in the Pacific. This is most likely due to food availability in the different areas. In addition, information on the difference in group sizes between the Atlantic (Azores/Caribbean) and the Pacific has been linked to a lack of orca predation in the Atlantic. The larger groups in the Pacific provide protection to individuals from orca attacks (Whitehead et al. 2012).

Data collected at this time of year are valuable to elucidate whether some of the same individual sperm whales remain in the archipelago for long periods of time. There is some indication that more 'unknown' individuals are present in the early part of the season with the 'known' animals arriving later. It would be very interesting to see which individuals are present in the archipelago over the winter. Maybe some groups prefer summer in the Azores and others prefer winter. The main obstacles to investigating this theory are the challenging weather in the winter as well as a lack of citizen scientists or tourists to pay for the trips to sea. The author attempts to get out as often as possible in the winter, but trips are few and far between when good weather and tourists are present on the same day.

Conclusion and outlook

The expedition and its annual reports have, since 2004, demonstrated the value of long-term studies on cetaceans. There should be more publications arising from the author's work on sperm whales in the next year or so. Initial work has started on using the matching information between islands to determine how often groups of sperm whales move between the central and eastern groups of islands.

In conclusion, this expedition was a success for the seventeenth year. More sperm whales than baleen whales were observed and there were quite a few dolphin sightings. The weather conditions during the expedition were quite good, making most sightings and data recording relatively easy. Re-sighting individual sperm whales from previous years continues to show the value of the Europhlukes & Happywhale matching programmes alongside digital cameras. We are able to identify individuals sighted on the day they are seen, rather than waiting until the end of the summer to do the matching manually. This is also a very satisfying way to end a day's work of observations.

The 2024 expedition should:

- continue the photo-ID work on the various species
- continue sorting and matching fin whales to confirm if they visit in multiple years and send to other catalogues around the Atlantic
- continue matching sei whales to confirm if they are visiting repeatedly as well as creating a catalogue of individuals and sending images to other catalogues around the Atlantic
- start matching false killer whales with a view to creating a catalogue of individuals
- put more effort into the trash survey, as part of the POPA programme, which began in 2016. Marine litter is already a huge problem, with micro plastics finding their way into the fish we eat

- continue to collect data with either the Monicet or the SEAFARI app, depending on which is more reliable. We should also continue to use a GPS device, which can download the track of the boat & sightings, which proved very successful again in 2023

- continue uploading new images and matching sperm and humpback whale flukes to Happywhale for matching to animals that are not included in the present catalogues compiled by the lead author.

Thank you to all expedition citizen scientists for your assistance.

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3. Observer Programme for the Fisheries of the Azores (POPA)

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3.1. Introduction

The Biosphere Expeditions research project took place between 21 March and 17 April 2023 in Faial Island (Azores, Portugal). Onboard of the vessel Physeter, citizen scientists recorded the occurrence of several marine species such as dolphins and seabirds (see figures below), as well as marine debris. The information recorded during the expedition were added to the POPA (translated as Azores Fisheries Observer Program) database.

POPA was launched in 1998 with the main goal of certifying the tuna caught around the Azores as a "Dolphin Safe" product. This label is attributed by the NGO Earth Island Institute to catches made without mortality of cetaceans. POPA has built an extensive database with information collected by independent observers on tuna fishing vessels. The database includes information on tuna fisheries (e.g. location of fishing events, catches, and fishing effort), weather conditions (e.g. sea surface temperature, wind and visibility), live bait fisheries (e.g. location of fishing events, catches, gear used), cetaceans (e.g. occurrences, interaction with fishing events and association with other species), birds and sea turtles (e.g. occurrences). Since 2015 the programme observers also collect information on marine debris. POPA is also responsible for the "Friend of the Sea" tuna fishery certification.

3.2. Results

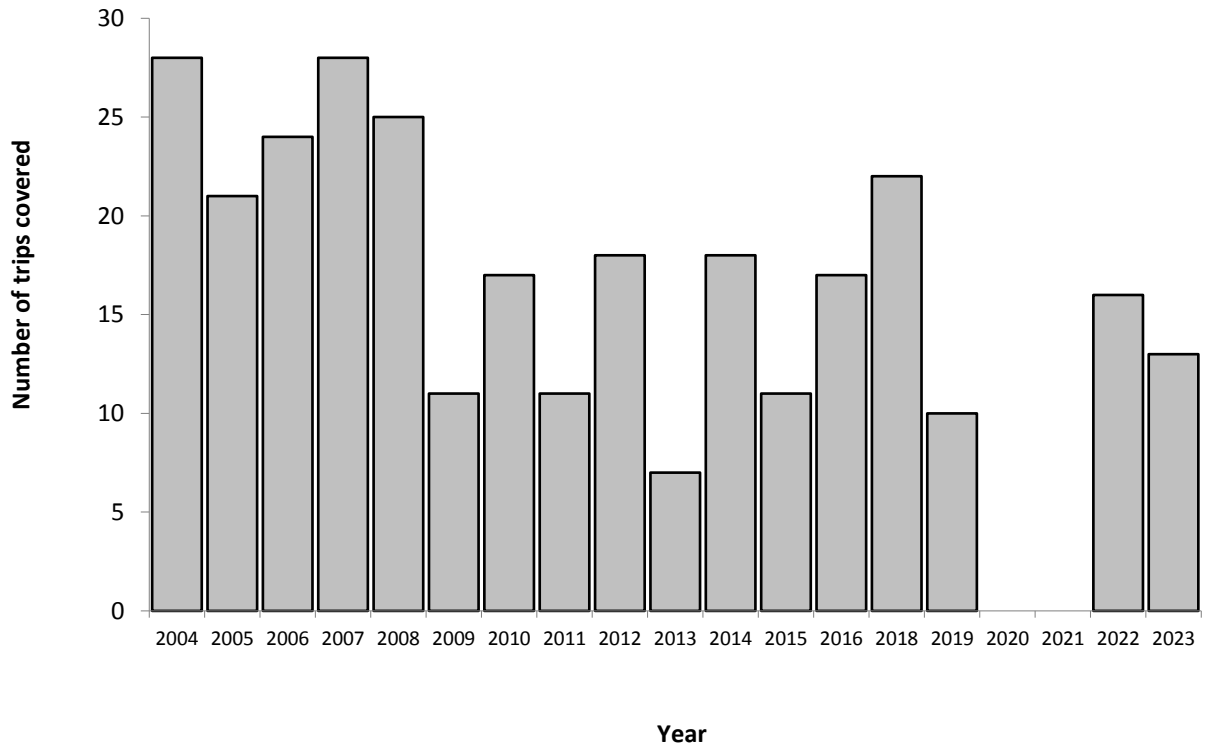

Figure 3.2a. Trip coverage during the 2004-2023 period.

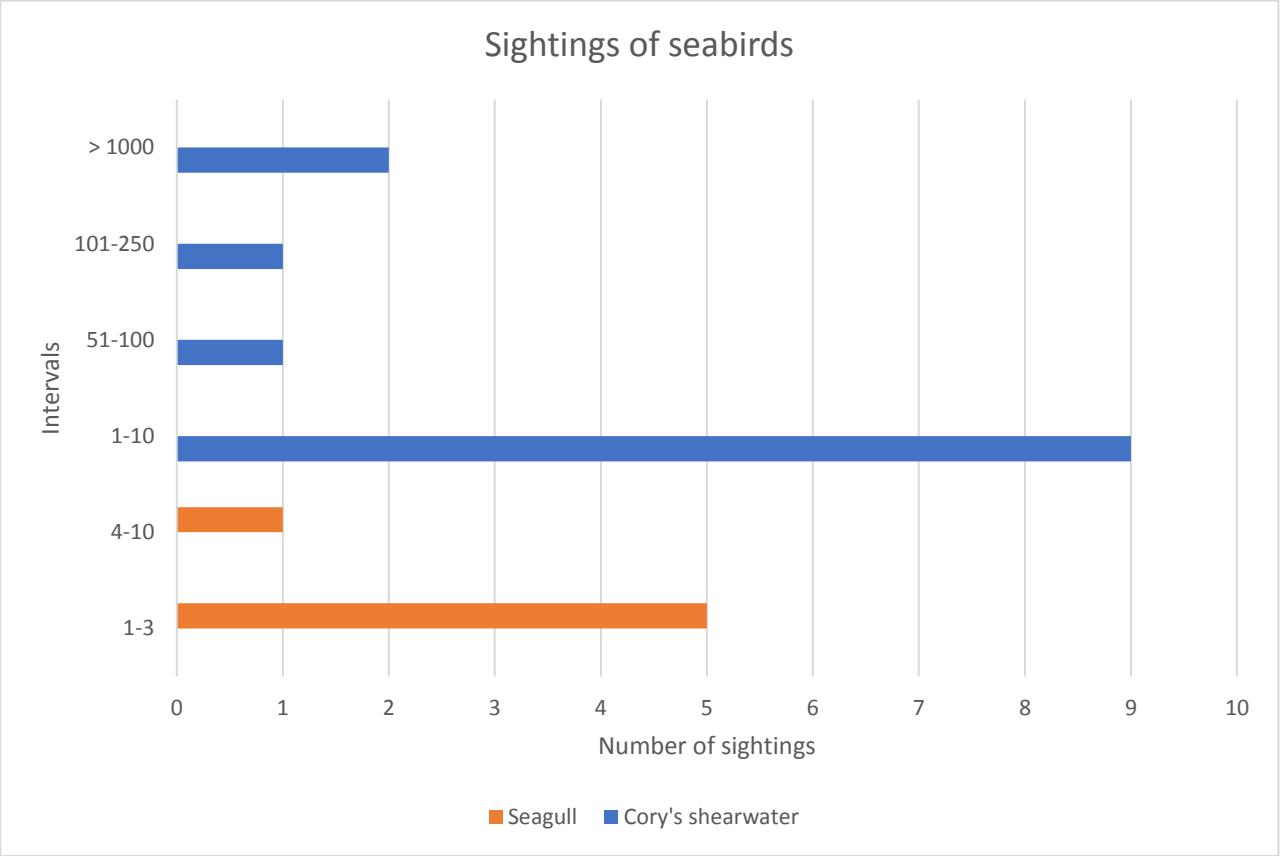

Figure 3.2b. Seabirds observed in 2023.

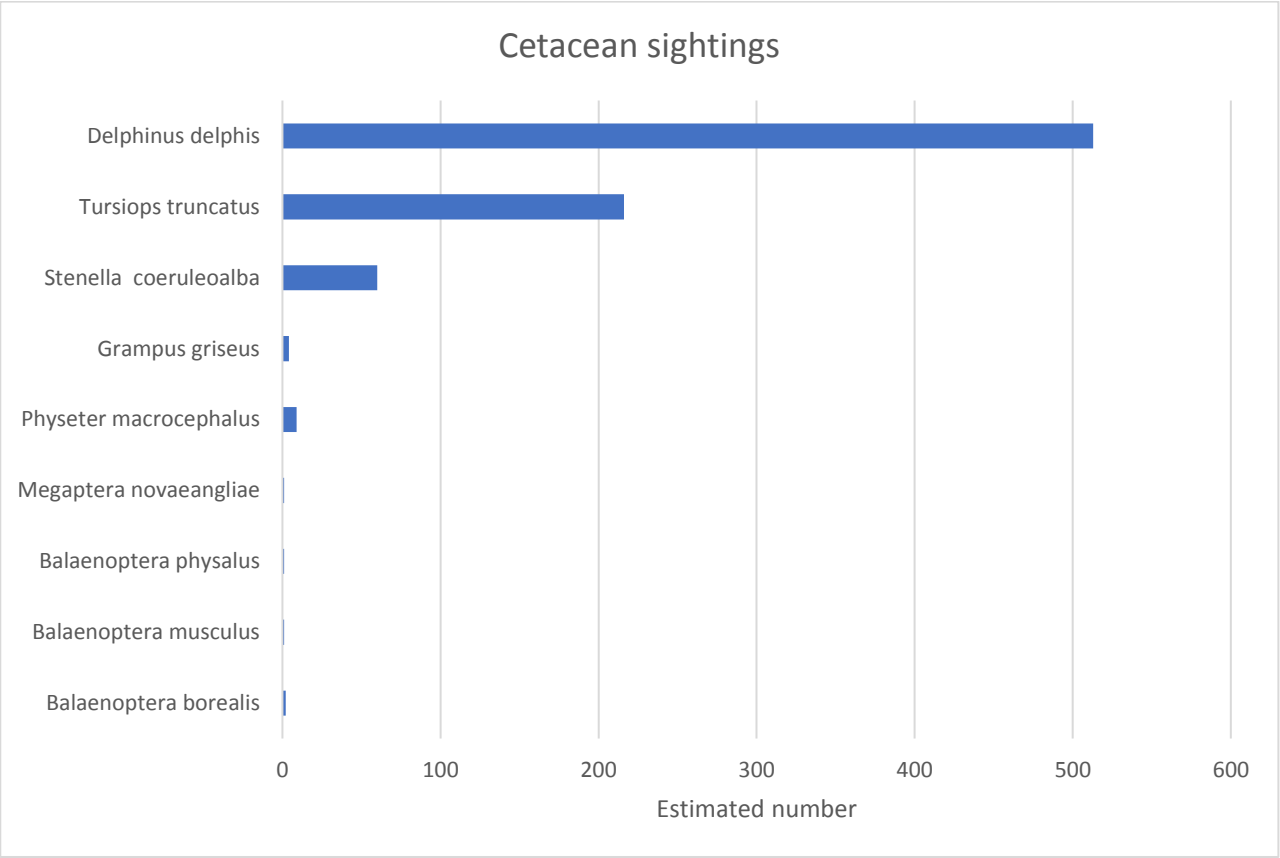

Figure 3.2c. Cetaceans observed in 2023.

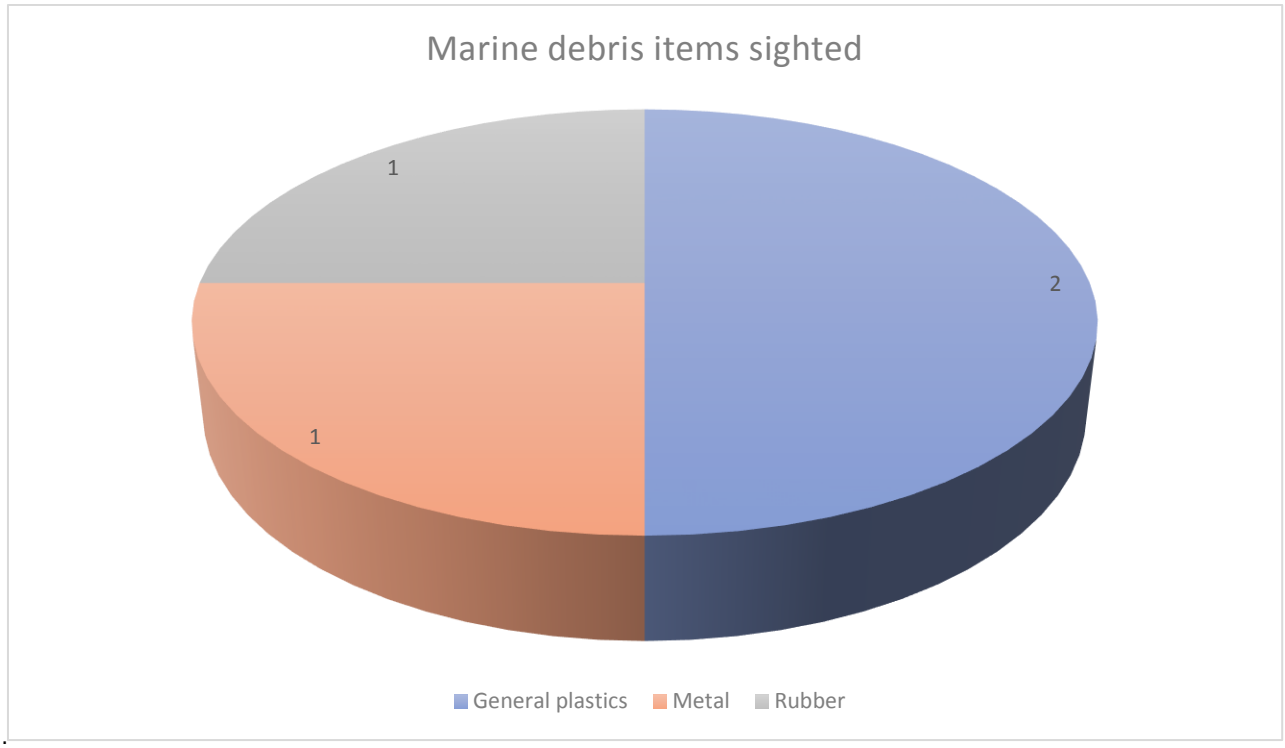

Figure 3.2d. Marine debris items (5-30 cm) observed in 2023.

3.3. Discussion

POPA has proved that accidental capture of cetaceans in the tuna fishery in the Azores is highly insignificant and no records of mortality of cetaceans have ever been reported (Silva et al. 2002, Cruz et al. 2016). But the programme has a much wider range than just the "Dolphin safe" topic. In recent years the POPA dataset has been requested frequently for several research projects regarding the ecology, biology and fisheries of target and associated species. Examples are the inclusion of POPA data in the OBIS-SEAMAP and EMODnet map databases and the papers published regarding information on fisheries' discards in the Azores (Fauconnet et al. 2019) and marine turtle distribution (Vandeperre et al. 2019). Besides the scientific outputs, the data collected by POPA observers are also available for NGOs, government and the fisheries industry.

3.4. Literature cited

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