



EXPEDITION REPORT

Expedition dates: 8 March – 19 April 2018

Report published: March 2019

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





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*no part of this report to be published without the main author's written permission

Abstract

In 2018 Biosphere Expeditions concluded its fourteenth successful 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 8 March to 19 April and concentrated on six main projects.

Sightings of all cetacean species were recorded. 111 sightings of eight different species of cetacean and one species of turtle were recorded during the expedition period.

Blue whale: The expedition encountered 18 blue whales in 18 encounters in 2018 and has contributed 126 individuals to the East North Atlantic catalogue since 2004. One blue whale sighted in 2018 was seen previously in the Azores in 2014.

Within the North Atlantic, where an estimated 2,000 cetaceans live, the rarity of matches 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. The 14% yearly re-sighting rate of blue whales from the Azores catalogue suggests that at least some individuals use a route past the Azores on their migration. Elucidating such movements and population locations and boundaries is important, because blue whale populations do not seem to be recovering their numbers at the same rate as other whales, making route determination with a view to establishing effective protected areas doubly important.

Fin whale: The expedition saw 18 fin whales in 17 encounters. Preliminary matching of individuals has begun, with the aim to send individual identifications to catalogues around the Atlantic.

Humpback whale: The expedition in 2018 encountered five humpback whales in three encounters. The North Atlantic Humpback Whale Catalogue is currently approaching 9,000 individuals and plays an important role in discovering long-range matches. Since 2004 the expedition has contributed 21 ID photos. This year, one of the whales seen was matched to an animal seen in Norway. Data collected during the expedition, as well as outside the expedition and by other researchers, suggest that the humpbacks that are seen in the Azores are part of the endangered Cape Verde population, rather than the Caribbean population. Matching movements and populations is important, because little is known about the movements of the Eastern Atlantic humpback whales.

No other baleen whales were observed in 2018.

The significance for whale conservation and research of these findings is that the Azores may provide a crucial 'pit stop' (between breeding grounds further South, possibly Mauritania and feeding grounds in Norway or Iceland) for some of the migrating animals that have not been feeding for a few months on the breeding grounds. The resources that they find in the Azores could be the difference between survival or death. Having a baseline of information on the number of animals and areas that they are using will also be useful in detecting any early changes in prey abundance due to global warming.

Sperm whale: Sperm whale photo-identification that has been ongoing since 1987 in the Azores, continued, with 19 identifiable individuals photographed from 41 encounters, including eleven animals seen in previous years. Matches now indicate that males 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 of 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 areas.

Dolphins: Dolphin photo-identification, which began in 1987, continued. Two groups of bottlenose dolphin and two groups of Risso's dolphin were photographed.

Europhlukes: Europhlukes was a Europe-wide project that brought together different researchers from several countries to share data and photo-identification pictures of various species. Sperm whale fluke extractions were made from the photos taken during the expedition and compared with 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 Institute of Marine Research/University of the Azores department, for the Azores Fisheries Observer Programme, POPA, was successfully collected for a fifteenth year. The expedition vessel "Physeter" is the only non-fishing vessel collaborating with the programme. Information was collected for random cetacean sightings along transects, as well as designated turtle and bird counts 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 57 loggerhead turtles were seen; none were caught and tagged due to adverse conditions.

Sumário

A “Biosphere Expeditions 2018” concluiu com sucesso o seu décimo quarto ano de recolha de dados sobre a distribuição de cetáceos nos Açores, com recurso a observações visuais e foto-identificação. A cidade da Horta, na ilha do Faial, foi a base da expedição e o trabalho foi conduzido em redor das três ilhas do Faial, Pico e São Jorge. Esta expedição decorreu entre 9 de Março e 19 de Abril, e concentrou-se em seis projectos principais.

Foram registados um total de 111 avistamentos de 8 espécies distintas de cetáceos e 1 espécie de tartaruga.

Baleia-azul: A expedição registou 18 baleias-azuis em 18 encontros em 2018 e, desde 2004, contribuiu com 126 indivíduos para o catálogo do Atlântico Nordeste. Uma baleia avistada em 2018 já tinha sido observada em 2014.

No Atlântico Norte, onde se estima viverem cerca de 2000 animais, é muito raro observarem-se reavistamentos entre os indivíduos dos catálogos da costa Este e os da costa Oeste, o que sugere existirem 2 populações distintas de baleias-azuis no Atlântico Norte. Uma delas parece viver entre o Sudoeste da Gronelândia e a costa da América do Norte, estando centrada nas águas do leste do Canadá. A outra população ocorre no estreito da Dinamarca, Islândia e “Jan Mayen, Spitzbergen”, e o Mar de Barents no verão, e a sul até à costa Noroeste de África no inverno. A taxa anual de 14% de reavistamentos de baleias-azuis do catálogo dos Açores sugere que, pelo menos alguns indivíduos, usam uma rota que cruza os Açores durante a sua migração. É importante obter informações sobre os movimentos, localização e zonas limite de ocorrência destes animais porque, ao contrário de outras baleias, as populações de baleia-azul não parecem estar a recuperar à mesma velocidade, o que faz com que a delimitação de áreas protegidas efectivas seja ainda mais importante (Richard Sears pers comm.).

Baleias-comuns: A expedição registou 18 baleias-comuns em 17 encontros. Iniciou-se uma análise preliminar dos avistamentos e reavistamentos de baleias-comuns, com o propósito de enviar as identificações individuais para os catálogos em redor do Atlântico.

Baleias-de-bossa: Em 2018, a expedição registou 5 baleias-de-bossa. O catálogo de baleias-de-bossa do Atlântico Norte está a aproximar-se de 9000 indivíduos e este desempenha um papel importante na detecção de reavistamentos de longo alcance. Desde 2004 que a expedição contribuiu com 21 fotografias identificativas. Neste ano, um dos indivíduos observados tinha sido fotografado anteriormente na Noruega. Os dados recolhidos durante esta expedição, juntamente com dados recolhidos por outros investigadores, sugerem que as baleias-de-bossa observadas nos Açores fazem parte da população ameaçada de Cabo Verde e não da população das Caraíbas. Estes reavistamentos são importantes, porque actualmente existe pouca informação sobre os movimentos das baleias-de-bossa na costa Este do Atlântico.

Não foram observadas outras baleias de barbas em 2018.

Os esforços desenvolvidos na conservação e investigação de baleias de barbas demonstram que os Açores poderão ser um ponto de paragem/abastecimento (entre as áreas de reprodução a sul e as áreas de alimentação a norte, como Noruega e Islândia) crucial para alguns animais migradores, que não tenham tido a oportunidade de se alimentarem nas áreas de reprodução, durante os últimos meses. Os recursos que eles encontram nos Açores podem significar a diferença entre sobrevivência ou morte. A recolha de informação base, sobre o número de animais e áreas que eles estão a usar, pode ser útil na detecção prévia de mudanças na disponibilidade de presas, devido a alterações climáticas.

Cachalote: Desde 1987 que está em curso nos Açores um programa de foto-identificação de cachalotes, com 19 indivíduos identificados e fotografados em 41 encontros, incluindo reavistamentos de 11 animais observados em anos anteriores. Os reavistamentos detectados indicam que os machos migram para as águas da Noruega e as fêmeas passam a sua vida em grupos e efectuam migrações/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 iniciou em 1987, tem continuado. Até ao momento conhecem-se 2 grupos de roazes e 2 grupos de grampos.

Europhlukes: Europhlukes foi um projecto Europeu que reuniu investigadores de diversos países para partilhar dados de foto-identificação de várias espécies. As extracções das caudas dos cachalotes fotografados durante a expedição serão comparadas com fotografias obtidas em anos anteriores e noutras áreas do Atlântico. Até ao momento nenhum dos cachalotes fotografados nos Açores foi reavistado noutras áreas.

POPA: Pelo décimo quinto 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 transectos de observação de cetáceos. Foram também efectuadas contagens 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, 57 tartarugas-boba foram avistadas, mas nenhuma foi capturada ou marcada.

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1. Expedition review

M. Hammer (editor)
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (biological or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to the Azores that ran from 8 March to 19 April 2018. 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.

The Azores Archipelago, which sits near the middle of the Atlantic Ocean, about 1,400 kilometres off the coast of Portugal, is one of the prime whale and dolphin hotspots in the world and around 30% of the world's known cetacean species have been recorded there. For management purposes the International Whaling Commission (IWC) has included the Azores Archipelago in the East Greenland and Iceland stocks, but there is little evidence to support this.

In 2004 the expedition initiated the first long-term concerted study on baleen whales in the Azores. These animals in particular had not been studied around the Azores. Accurate knowledge of the origins of the baleen whales passing the archipelago on their migration from March to May will help to determine which stocks they come from and assess more accurately their true numbers (which are often inflated in efforts to set hunting quotas).

The expedition also continued with existing sperm whale, bottlenose and Risso's dolphin studies. The sperm whale study is part of a larger migration and social study, and the dolphin study is in the early stages of assessing animal numbers and migratory behaviour around the archipelago. Loggerhead turtles were also studied and tagged as part of an international research project studying their life history and migration around the Atlantic.

1.2. Research area

The Azores Archipelago, Europe's westernmost point, is a group of nine distinct islands, lying on the same latitude as New York and Lisbon, around 1,400 kilometres off the coast of Portugal (of which they are part). Lying on the Mid-Atlantic Ridge, the islands display spectacular volcanic scenery, with large blue-green crater lakes, impressive black lava sea cliffs, and, towering above them all, the highest mountain in Portugal on Pico.



Figure 1.2a. Map of the Azores.
An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at [Google Maps](#).

The Azores were discovered in 1427 by Portuguese explorers and colonised shortly after by people of mainly Portuguese and Flemish descent. During the 20th century the islands were an important stopover point for undersea communications cables, transatlantic flights and yachtsmen. The islands' main income is from agriculture and fishing; tourism has all but passed by the islands.

1.3. Dates

The expedition ran over four ten-day groups.

8 - 17 March | 19 - 28 March | 30 March - 8 April | 10 - 19 April 2018

Team members could join for multiple slots (within the periods specified). Dates were chosen to coincide with the migration of baleen whales past the archipelago.

1.4. Local conditions & support

Expedition base

The expedition team was based on the island of Faial, near the harbour in a guesthouse consisting of modern twin and double rooms. Dinner was eaten at local bistros/restaurants or the expedition base, a breakfast buffet was served by participants on a rota and each participant prepared a lunch pack from the buffet. Vegetarians and some special diets were catered for. Accommodation was on a twin-share basis.

Weather

The climate is mild maritime Mediterranean with daytime temperatures during the expedition months from 10° to 24°C. Extremes are usually buffered by the Gulf Stream passing by, but it could get quite cold, especially on the boat, with the wind chill factor.

Field communications

The boat carried two radios for communication with other boats. Mobile phones did work on the island and within a few kilometres out at sea. There was also (limited) wireless internet access at base via a public server. The expedition leader posted a [diary with multimedia content on Wordpress](#) and excerpts of this were mirrored on [Biosphere Expeditions' social media sites](#).

Transport, vehicles & research vessel

Team members made their own way to the Horta assembly point. From there onwards and back to the assembly point all transport, vehicles and boats were provided for the expedition team for expedition support and emergency evacuations.

Our research vessel, the Physeter (after the Latin name for sperm whale), was a modern offshore motor catamaran with large fore and aft decks and equipped with life raft, lifejackets, emergency beacon, two radios, radar, fish finder and other safety features.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. The standard of medical care in the Azores is high and further medical support was available at a hospital in town. All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation. Emergency procedures were in place, but did not have to be invoked as there were no medical or other emergencies.

1.5. Expedition scientist

Biosphere Expeditions works on this project with Lisa Steiner of Whale Watch Azores. Lisa graduated in Marine Science in 1988 at the University of Miami and joined the IFAW (International Fund for Animal Welfare) cetacean research vessel "Song of the Whale" two weeks later, which at the time was based in the Azores. Since then Lisa has spent all her summers working on cetaceans around the Azores and at other times has also studied them in Alabama, Hawaii, Cape Verdes, Bermuda, Scotland and Madeira. She has published numerous research papers on cetaceans.

1.6. Expedition leaders

Catherine Edsell led the first group. Catherine was born in the UK into a family of mountaineers, skiers and adventurers. With wanderlust in her blood she left England in 1997 and set off to the jungles of Central America and Indonesia, lived in the Himalayas with locals, trekked through the Namib desert in search of elusive elephants and dived the oceans surveying coral reefs. Her passion for conservation grew as she sought out and trained with expedition organisations that echoed her ecological beliefs, and for seven years straight, her feet barely touched British soil as she lived the expedition life in all manner of terrains. In 2014 Catherine was awarded a fellowship of the Royal Geographical Society for her continued contribution to conservation through expedition work. She is also a mountain leader, PADI Divemaster, coral reef ecologist and Reef Check trainer, and has led expeditions in the Azores, the Maldives and Musandam for Biosphere Expeditions. When not on expedition, Catherine teaches yoga, rock-climbs and dabbles in the flying trapeze.

Craig Turner led the other three groups. Craig was born in Oxford, England. He studied biology, ecology and environmental management at Southampton, Aberdeen and London universities. Soon after graduating from his first degree, he left the UK for expedition life in Tanzania. Since then, he has continued to combine his interest in travel and passion for conservation, working with a wide range of organisations on projects and expedition sites in the Americas, Africa, Asia and the Pacific. He has managed expedition programmes for the Zoological Society of London, and is a frequent contributor to the 'Explore' conference held by the Royal Geographical Society (RGS). He is a Fellow of the RGS and the Linnean Society. Having visited and/or worked in more countries than years have passed, he now runs a small environmental consultancy with his partner, based in Scotland, where he splits his wildlife interests and work between the UK and overseas. He also crews for the RNLI and is casualty care trained. He is ever keen to share his exploits, writing for several magazines, and is a published photographer.

1.7. Expedition team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were (with country of residence):

8 – 17 March 2018

Rebecca Band (UK, press), Jasmin Benz (Germany), Donna Hensel (USA), Georg Keller (Switzerland), Anke Moellenkamp (Germany), Carla Olvido van Barneveld Pérez* (Spain, placement), Petra Paul (Germany, press), Silvia Pesci (Italy, press).

19 – 28 March 2018

Cecilia Cecchi (Italy), Corinna Bischoff (Germany), Astrid Därr (Germany, press), Lara Marowsky (Germany), Silke Mohl (Germany), Katharina Sollinger (Germany), Veronika Sollinger (Germany), Andrea Wieland (Germany), Thomas Wieland (Germany), Andreas Zemann (Germany).

30 March – 8 April 2019

Mariluz Coello (Ireland), Carsten Hauck (Germany), Thomas Klaus (Germany), Michael Lindemann (Germany), Sabine Nerge (Germany), Stephan Nerge (Germany), Hanna-Mari Pekkarinen Rieppo (Sweden), Sofia Refsnes (Sweden), Claire Wallace (UK), Philip Wallace (UK).

10 – 19 April 2019

Jenan Anwar Alasfoor (Oman), Julia Balasch (Austria), An Bollen (Belgium, assistant expedition leader), Winfried Diehm (Germany), Annabel Marriott (UK), Christine Marshall (UK), Aurelia Perrio (UK), Amy Danute Perrio (UK), Anne Schroedter (Germany), Siân Smith (UK).

*Placement kindly supported by the [Friends of Biosphere Expeditions](#) and a GlobalGiving crowdfunding campaign. The [Biosphere Expeditions placement programme](#) seeks to identify, train and encourage the next generation of local conservationists.

1.8. Partners

Our main partner on this project 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).

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. Without our expedition team members (listed above) who provided an expedition contribution and gave up their spare time to work as research assistants, none of this research 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, the University of Florida, and the local community of whale spotters (vigias). A final thanks goes to skippers Gyro & Nuno, as well as James Rosa and Claudia Steube, our excellent hosts at Banana Manor.

1.10. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at info@biosphere-expeditions.org.

1.11. Expedition budget

Each team member paid towards expedition costs a contribution of €1,740 per person per 10-day slot. 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	55,525
Expenditure	
Base camp and food includes all board & lodging, base camp equipment	11,572
Research vessel & transport includes fuel, oils, wear & tear for research vessel, taxis on land	8,062
Equipment and hardware includes research materials & gear, etc.	635
Staff includes local and Biosphere Expeditions staff & expenses	11,964
Administration includes registration fees, sundries, etc.	488
Team recruitment Azores as estimated % of PR costs for Biosphere Expeditions	8,676
Income – Expenditure	13,855
Total percentage spent directly on project	75%

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2. Whale & dolphin study

Lisa Steiner*

Whale Watch Azores

*no part of this report to be published without the main author's written permission

2.1. Introduction

The Azores is a group of nine islands located about 900 nautical miles off the coast of Portugal. 28 species of cetacean have been seen around 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 has been done around the archipelago earlier in the year than June, which is why the expedition usually takes place in April and May. In 2018, the expedition started earlier than before, in March, to try and take advantage of some of the early migrating whales.

Baleen whales have been seen fairly regularly migrating past the islands from March to June over the last several years, but it is unknown where they have come from or where they are migrating to. It is thought that they are travelling north to feed in the waters around Iceland, Greenland, Norway or even Nova Scotia for the summer. Photo-identification of the animals passing the Azores enables us to match photos with photos taken elsewhere to hopefully determine some of these migration routes. So far, there have been several matches between blue whales to other areas: several of the animals sighted in Spitzbergen, Norway have also been seen in the Azores. There are two matches between the Azores and 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 of blue whales to Northern Spain and Ireland. In addition several blue whales have now been seen in multiple years in the Azores. Twelve humpback whales have been observed in both the Azores and the Cape Verde Islands and ten have also been re-sighted in Norway. Two individuals have been seen in all three places. A new match of a humpback has also been made to Newfoundland! There are still no matches to the Caribbean.

Although sperm whales were caught 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, March and April, has given us the opportunity to see that females and calves are present at this time of year as well as in the summer months. In the future, we would like to expand the effort to include the winter months to see if some females and calves are present in the archipelago all year round.

Photo-identification of sperm whales began in the Azores in 1987 and over 3000 individuals have been identified since then. The Europhlukes' matching program makes matching individuals much faster than it was manually.

Some bottlenose and Risso's dolphin are resident in the islands year round. By photographing individuals 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 on the computer to identify individuals and their groups. Most of this work will be done in the future by MSc or PhD students.

2.2. Methods

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. They would begin to look for whales at around 07:30 to be able to direct the boat on departure at 09:00. If the lookouts did not sight any whales, the boat was equipped with a towed hydrophone to locate sperm whales acoustically. The boat also had up to four additional lookouts onboard, three on the bow and one in the stern searching for cetaceans. Two expedition members were usually dedicated to filling in POPA forms (transects and bird, turtle and trash surveys) (Figure 2.2a). Other crew were on camera duty (Figure 2.2b), completing data sheets, hydrophone monitoring (Figure 2.2c), filling in the log or collecting water temperatures when required. On occasion crew members may have had to do more than one job.



Figure 2.2a. POPA sheet duty.



Figure 2.2b. Camera duty.



Figure 2.2c. Hydrophone deployment and listening.

Sperm whales were approached from behind in order to obtain fluke photographs. The baleen whales were also approached from behind but moving further forward to obtain photographs of dorsal fins as well as chevron (fin whale) and mottling (blue whale) patterns. Bottlenose and Risso's dolphin were approached alongside in order to obtain dorsal fin photographs for identification of individuals. Two cameras were used to obtain the ID photographs: a Canon 7D MK II with a Canon 100-400 mm lens and a Nikon F70 with a 70 – 300 mm lens.

Other dolphin sighted would be approached for species identification and then the boat would usually move on to look for other animals if they were not one of the main target species. 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 were differentiated because generally not enough time was spent with the animals to break them down further. If the animals were travelling, a 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 was also recorded as was the presence of other whale watching vessels.

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, whale sex (ascertained by a visible callous: a growth on the top of the dorsal fin which indicates the whale is female), position, fluke heading, defecation and the presence of other whale watching boats.

When loggerhead turtles were sighted their position was recorded on the POPA forms. If the animal was caught, then it would be measured and tagged for the University of Florida/University of the Azores turtle tagging programme, as well as positional data being recorded.

When the boat returned to port, there was a debrief on board to show where the boat had been during the day (Figure 2.2d) and sperm whale photos could be later matched to the catalogue (Figure 2.2e).



Figure 2.2d. Daily debrief.

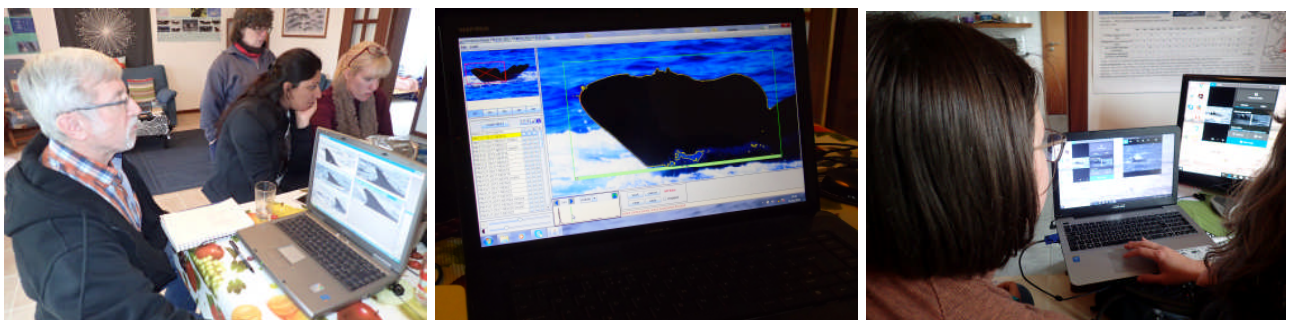


Figure 2.2e. Matching flukes & fins.

Results were analysed using EXCEL data analysis tools: summary statistics to obtain average group sizes and ranges.

2.3. Results

2.3.1. Effort

Physeter normally left the harbour around 09:00 and returned around 16:00, weather permitting. The boat went to sea 22 days during the expedition and spent between 1.75 and 8.25 hours (hr) per day on the water, with an average of 5.5 hr. A total of 120.5 hr with sea conditions below sea state 5 were recorded. In 2018, this included 18.5 hr with a sea state of 4, only a fraction below sea state 5. A comparison of the yearly effort since 2004 is presented in Figure 2.3a (next page). It should be noted that prior to 2009, expedition slots were 13 days and have since been reduced to 10 days in order to make the expedition accessible to a wider audience. Also note that in 2009, 2011, 2013 and 2015 there were no groups in May. There was no expedition in 2017 and in 2018 the expedition began in March for the first time with no groups in May.

2.3.2. Encounters

During the expedition 70 groups of non-sperm whales and 41 sperm whale groups were encountered (Table 2.3a.).

Table 2.3a. Species encountered (number of encounters).

COMMON DOLPHIN, <i>Delphinus delphis</i>	26
BOTTLENOSE DOLPHIN, <i>Tursiops truncatus</i>	2
RISSO'S DOLPHIN, <i>Grampus griseus</i>	2
STRIPED DOLPHIN, <i>Stenella coeruleoalba</i>	2
BLUE WHALE, <i>Balaenoptera musculus</i>	18
FIN WHALE, <i>Balaenoptera physalus</i>	17
HUMPBACK WHALE, <i>Megaptera novaeangliae</i>	3
SPERM WHALE, <i>Physeter macrocephalus</i>	41

These encounters resulted in a relative sightings frequency as shown in Figure 2.3b. Sperm whales were the species encountered most at 37%, followed by common dolphin (23%) followed by blue whales (16%) and fin whales (15%). These four species accounted for over 90% of all sightings.

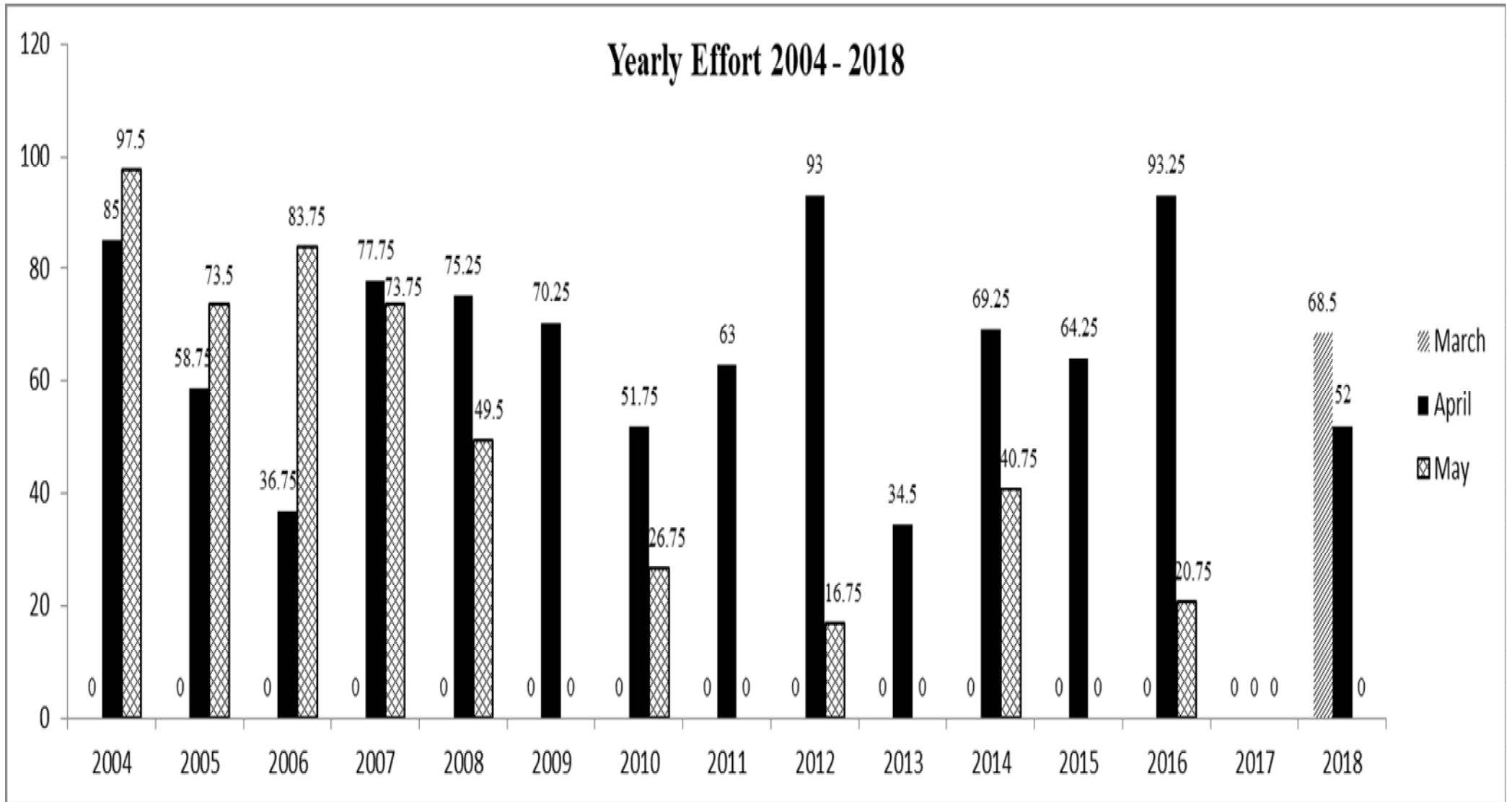


Figure 2.3a. Yearly effort (in sea time hours).

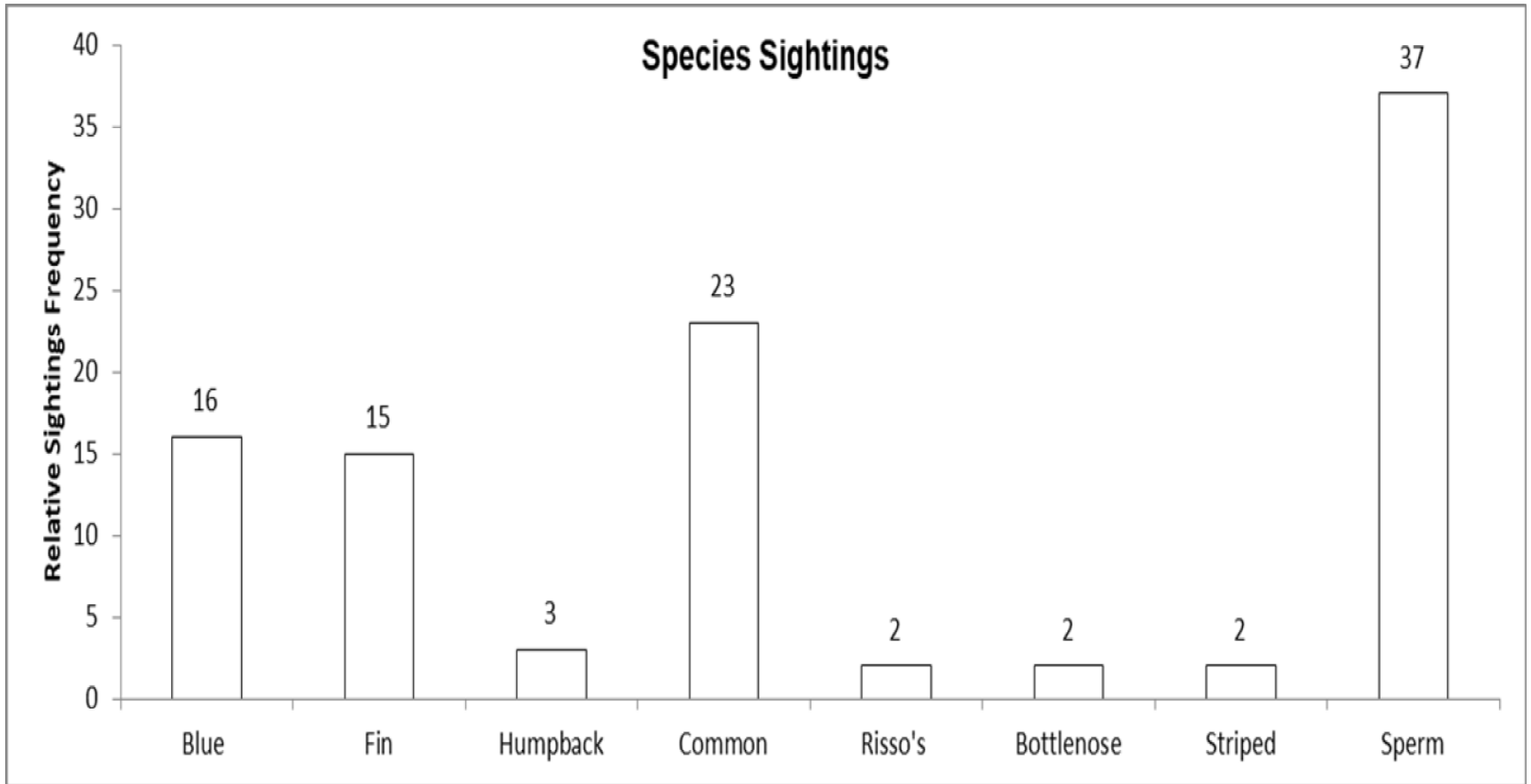


Figure 2.3b. Species sightings frequency.

2.3.3. Species sightings

Common dolphin

This species was encountered 26 times. The group size ranged from 2 - 80 and the average group size was 27 (Figure. 2.3c). This group size is consistent with the average group size from existing data for June-September. Calves were first observed on 22 March 2018 and seen eight times in total during the expedition. There was a significant difference in group size when calves were seen in the group: an average of 53 versus 15 when no calves were present in the group (t-test $t < .05$). This is what is generally thought, that calves are present in larger groups, which provide more protection for the youngsters.

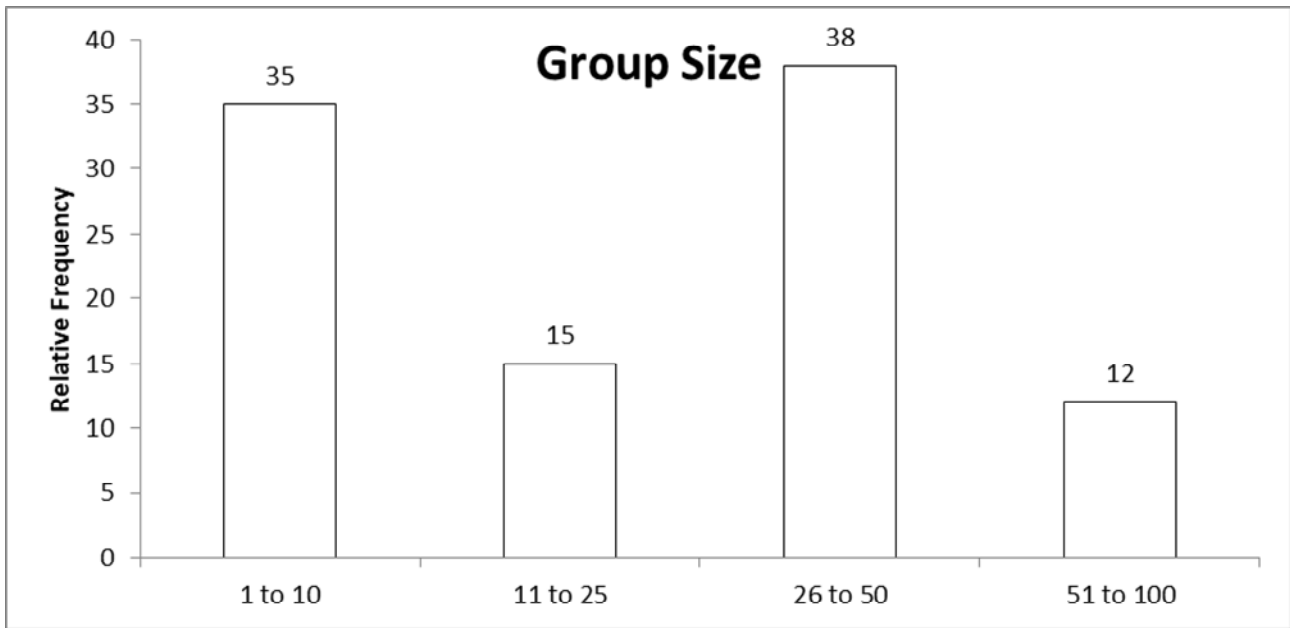


Figure 2.3c. Common dolphin relative group size.

The most common behaviour observed by common dolphin was bowriding, followed by milling then travelling. They were seen feeding on four occasions (Figure 2.3d).

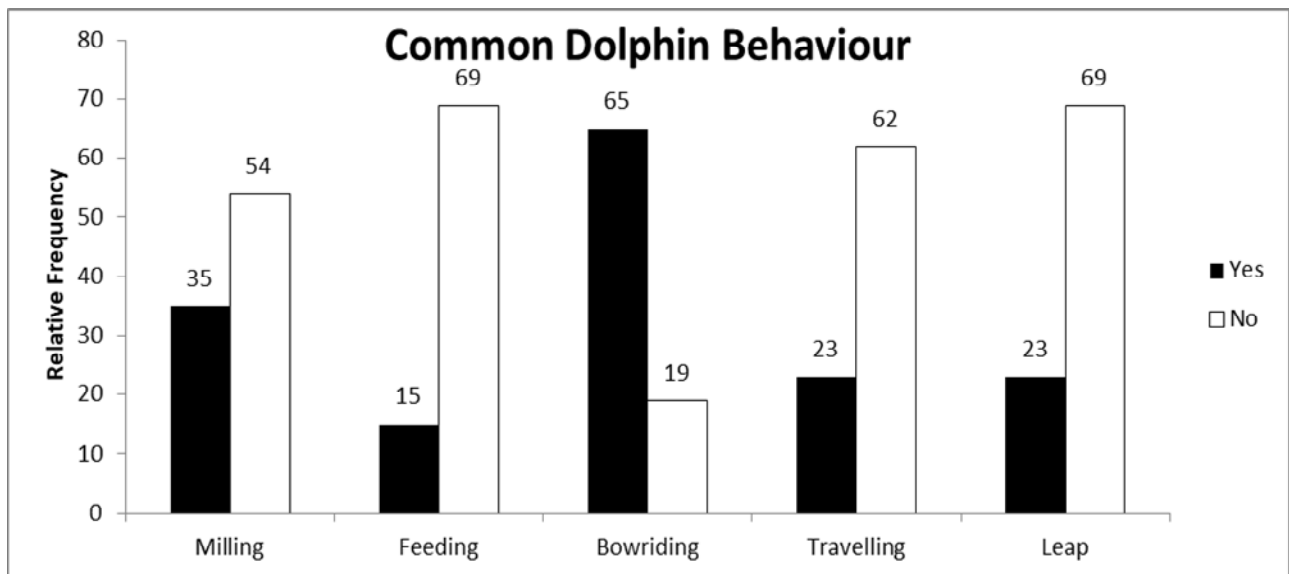


Figure 2.3d. Common dolphin behaviour.

Bottlenose dolphin

This species was observed twice in March. The group sizes were 30 and 150. Calves were seen on both occasions.

The dolphins were milling during both encounters and bowriding occurred with the larger group, which appeared to be socialising with quite a few leaps seen during the encounter.

Photo identification pictures were taken during the encounters and some of the resident animals were seen (Figure 2.3e). Photos will be analysed in more detail at a later date.



Figure 2.3e. Bottlenose dolphin photo ID.

Risso's dolphin

Two small groups of Risso's dolphins were seen, one group of three and another of four. The group of four comprised two mother/calf pairs. Photographs were taken of dorsal fins of both groups (Figure 2.3f). One individual "Resa", seen in both groups, has been encountered since 2006 and now has her third calf (Karin Hartman pers. comm.).



Figure 2.3f. Risso's dolphin dorsal fin photo ID (more below).



Figure 2.3f. Risso's dolphin dorsal fin photo ID (continued).

Striped dolphin

Striped dolphins were also seen twice: one group of five including a couple of calves and another group of 30. The small group was milling, while the larger group was travelling. Striped dolphins do not bowride often in the Azores.

Blue whale

Blue whales were observed on 18 occasions, all single individuals. During most of the encounters the animals were milling (13), in the other five sightings, they were travelling. No surface feeding was observed, but the animals may have been feeding at depth while milling. Several individuals showed their fluke when diving.

Identification photos of mottling patterns around the blowhole or dorsal fin as well as the occasional fluke (Figure 2.3g) were taken of all the animals and sent to Richard Sears for matching to the Atlantic catalogue. A blue whale seen in April had previously been seen in the Azores in 2014. There were no long distance matches to blue whales seen during the expedition.



Figure 2.3g. Blue whale photo ID (more below).



Figure 2.3g. Blue whale photo ID (continued).

Fin whale

Fin whales were seen 17 times during the expedition: one pair of whales and the rest single individuals. The behaviour of the animals was split fairly evenly between travelling and milling. There was one recorded instance of feeding, although they may have been feeding at depth while milling during other encounters.

Photo identification pictures of the chevrons and dorsal fins were obtained (Figure 2.3h) and these photos were sent to the College of the Atlantic for matching to their Atlantic catalogue. No matches have been found so far.



Figure 2.3h. Fin whale photo ID.

Humpback whale

Humpback whales were recorded three times during the expedition: one group of three individuals and two other single individuals. ID photos were taken of the flukes and sent to the North Atlantic Humpback Whale Catalogue. Three different individuals were identified with fluke photos over the expedition. One of the whales seen on the 22 March 2018 was seen in Northern Norway in 2014, 2015 and close to Russia in 2016 (Figure 2.3i).



Figure 2.3i. Humpback whale photo ID.

Sperm whale

Sperm whales were one of the main target species of the expedition. They were encountered 41 times, comprising 72 animals (not all different individuals). The average group size was 1.75, ranging from 1 – 4, which is similar to that encountered during other parts of the summer. Two different large males were seen and females with calves were observed 15 times. 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 (Figure 2.3j). 19 individuals were identified in total. Eight new animals and eleven re-sighted from previous years were seen.

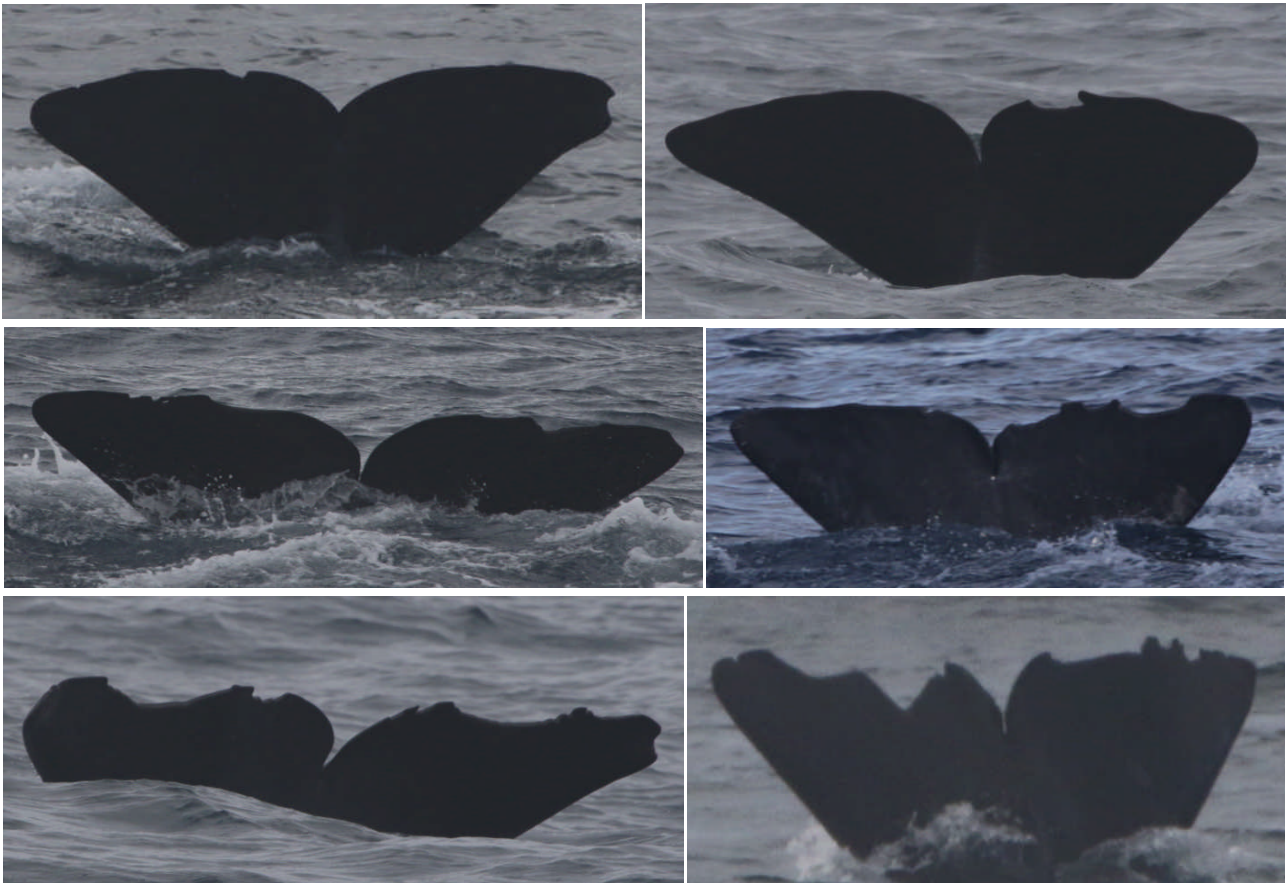


Figure 2.3j. Sperm whale photo ID.

Miscellaneous sightings

Loggerhead turtles were observed 57 times during the expedition, none were caught for tagging (Figure 2.3k). These turtles feed mainly on jellyfish.



Figure 2.3k. Loggerhead turtle.

Sighting locations during the expedition

Figures 2.3l-o show locations of species sightings in relation to the islands of Pico, Faial and São Miguel, and over the four expedition groups.

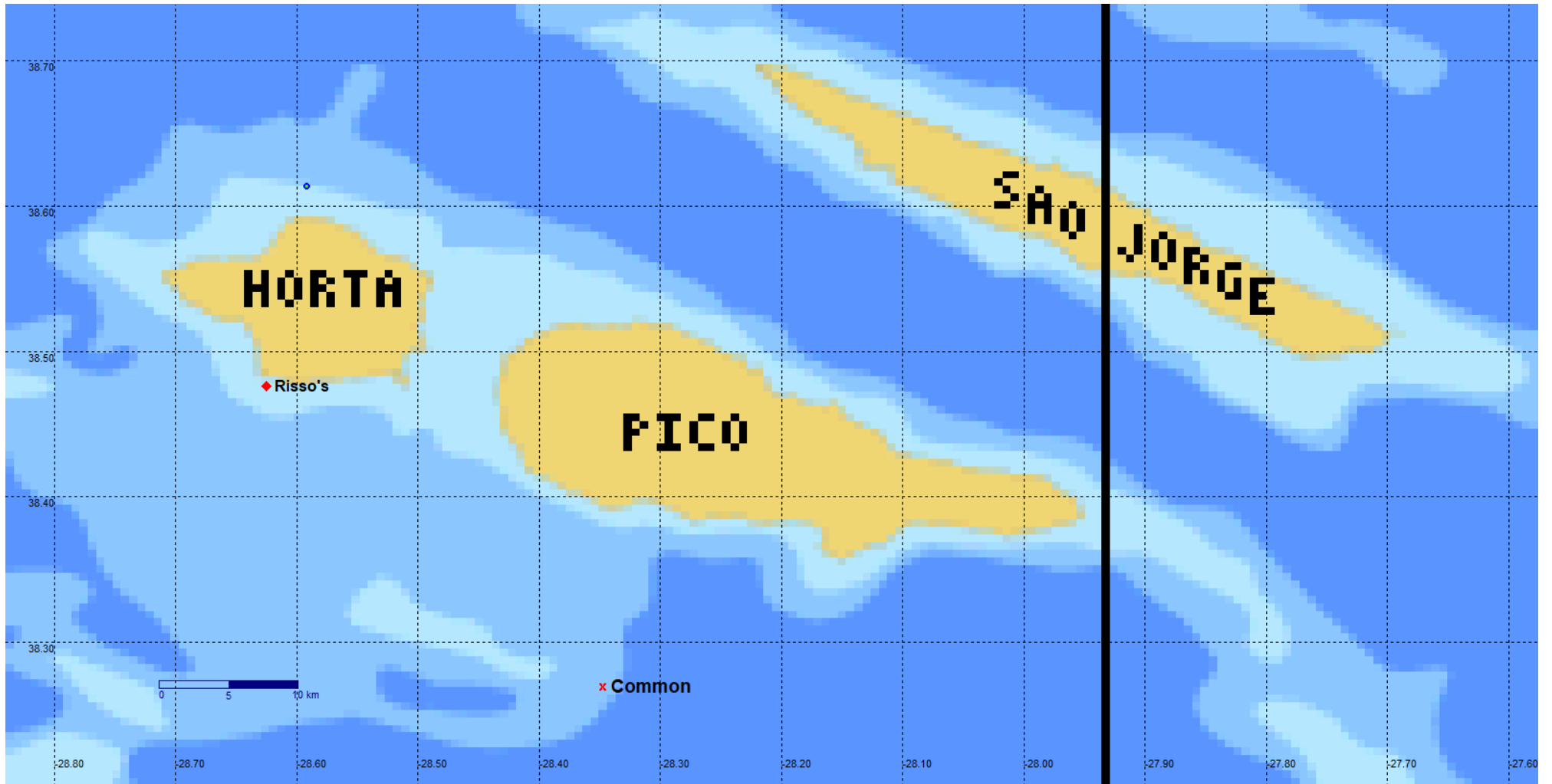


Figure 2.3I. Sightings during group 1 (8 - 17 March 2018).

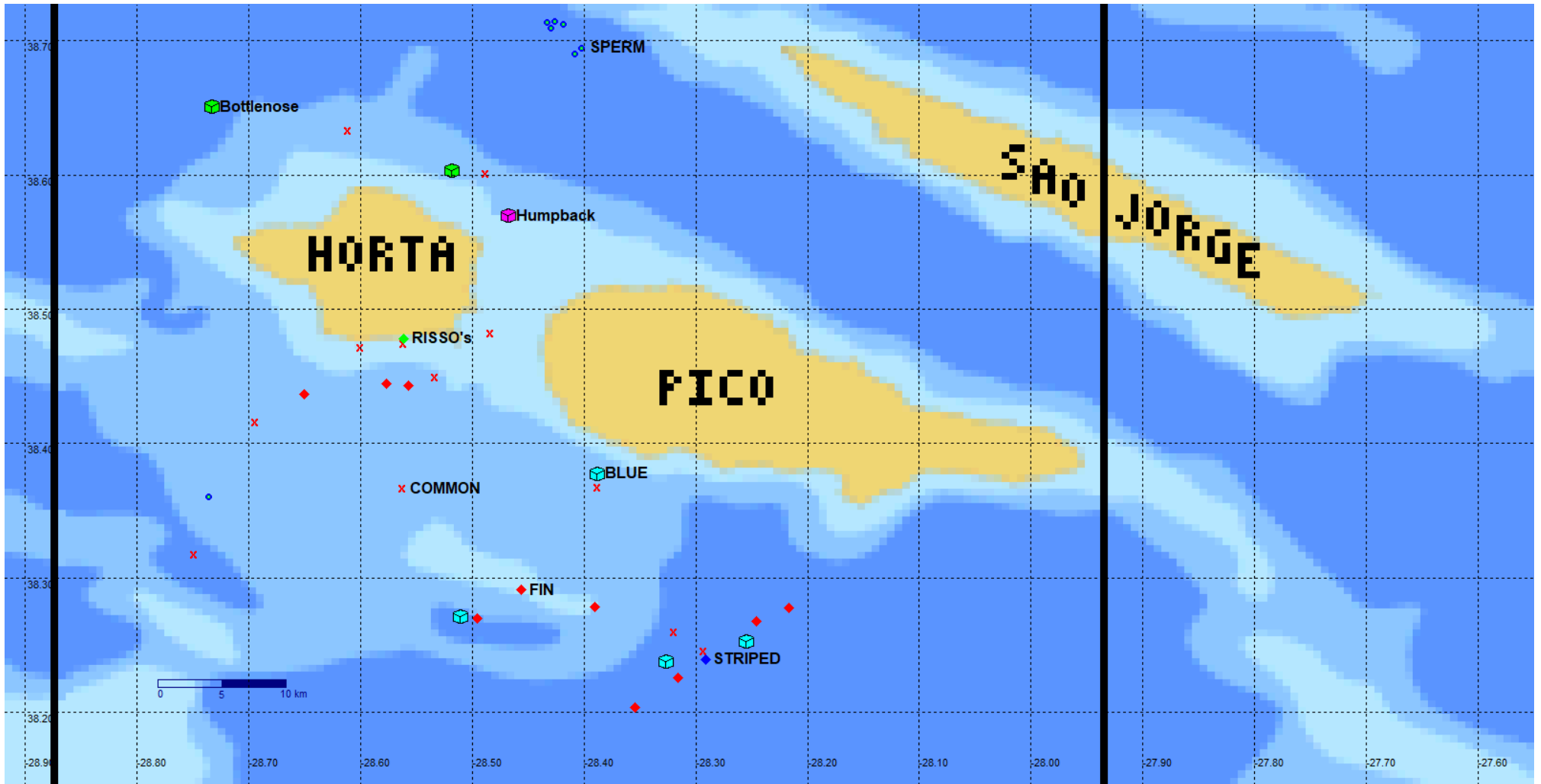


Figure 2.3m. Sightings during group 2 (19 - 28 March 2018).

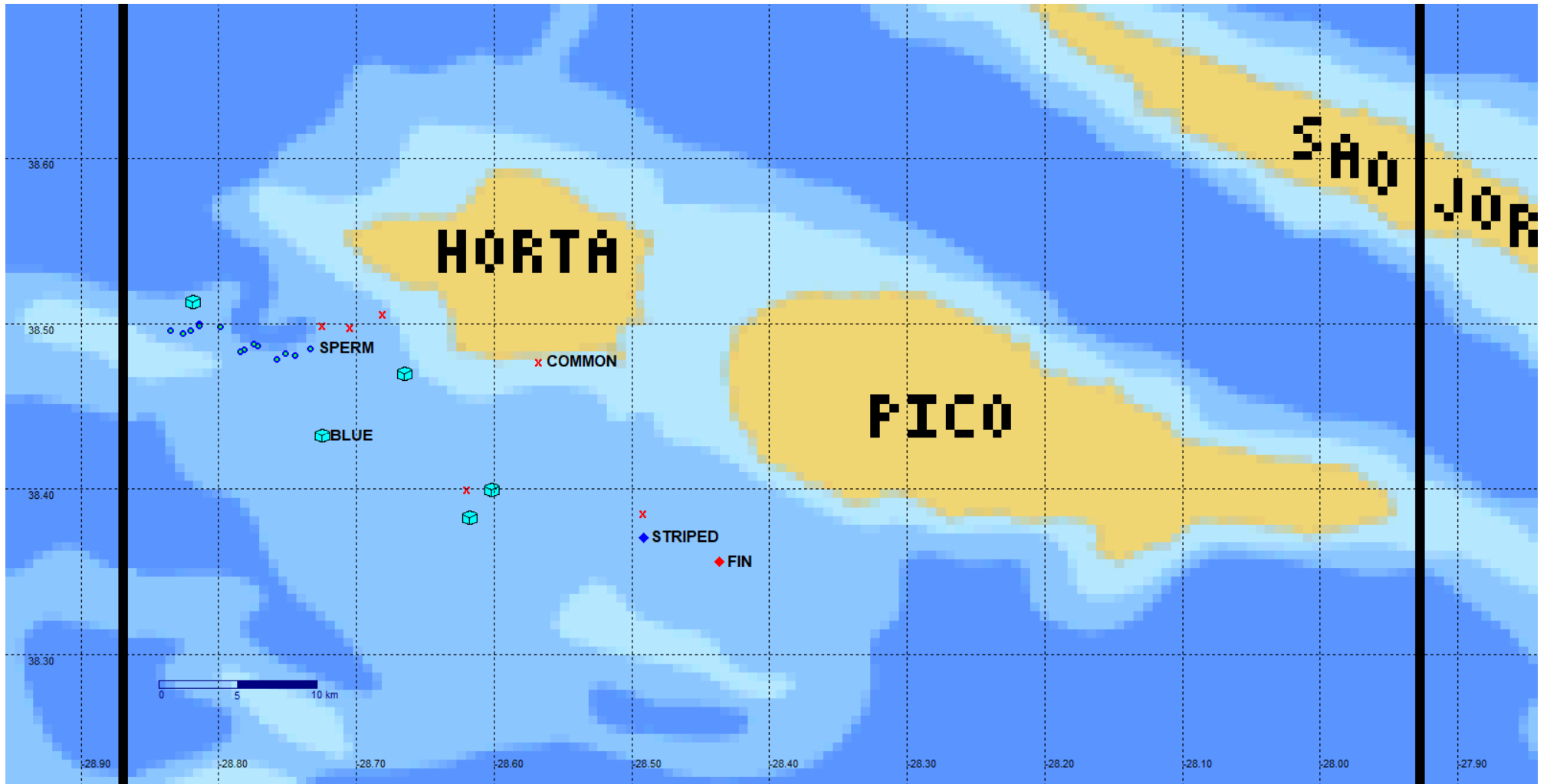


Figure 2.3n. Sightings during group 3 (30 March – 8 April 2018).

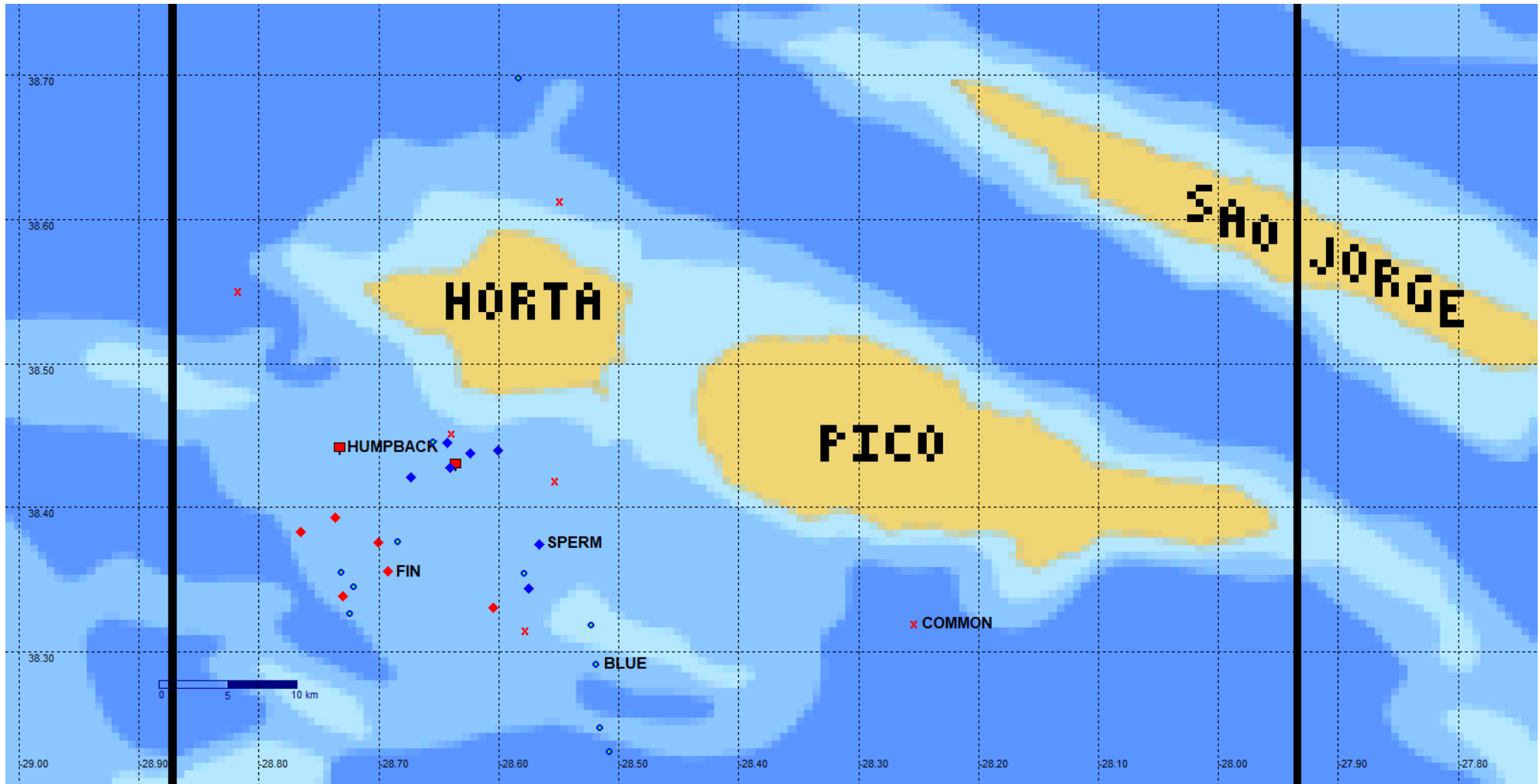


Figure 2.3o. Sightings during group 4 (10 – 19 April 2018).

2.4. Discussion & conclusions

March, April and May are a productive time in the Azores, often with large patches of krill sighted. Biosphere Expeditions continues to play an important role in collecting vital information at a time of year when little or no research work has been done before Biosphere Expeditions arrived. 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 any other time of the summer. Sightings of baleen whales are unpredictable, but the use of lookouts (vigias) on the cliffs greatly enhances the chance of sighting them.

The weather in 2018 was not favourable for our surveys. While we did manage to get out to sea for over 120 hours, we were often limited where we could be working and also working in difficult conditions. When the sea state is over 3, it becomes very difficult to spot dolphins, which accounts for a lack of sightings in this category.

Group 1 was adversely affected by the weather for most of the time, affecting the number of sightings. We did hear sperm whales on the hydrophone on two different days, but were unable to locate them in the time available.

Blue whales

The expedition encountered 18 blue whales in 18 encounters in 2018 and has contributed 126 individuals to the East North Atlantic catalogue since 2004. One of the individuals identified had been seen previously in the Azores in 2014. No matches were found to other areas of the North Atlantic.

The Azores blue whale catalogue now contains roughly 450 individuals (not all the author's photos), making up the majority of the North East Atlantic Blue Whale Catalogue (700) out of an estimated 2,000 animals in the North Atlantic.

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 (Figure 2.4a). This is also supported by the genetic structure of blue whales across the Atlantic (Oosting et al. 2014 in Sears et al. 2015). Tags put on blue (and fin) whales by the University of the Azores show northerly movement of blue whales from the Azores (Figure 2.4b), corroborating evidence for blue whale northward routes from the Azores that stay within the East North Atlantic population/catalogue.

One of the trans-Atlantic matches occurred in 2014. After the expedition, a blue whale was seen on 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. 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.

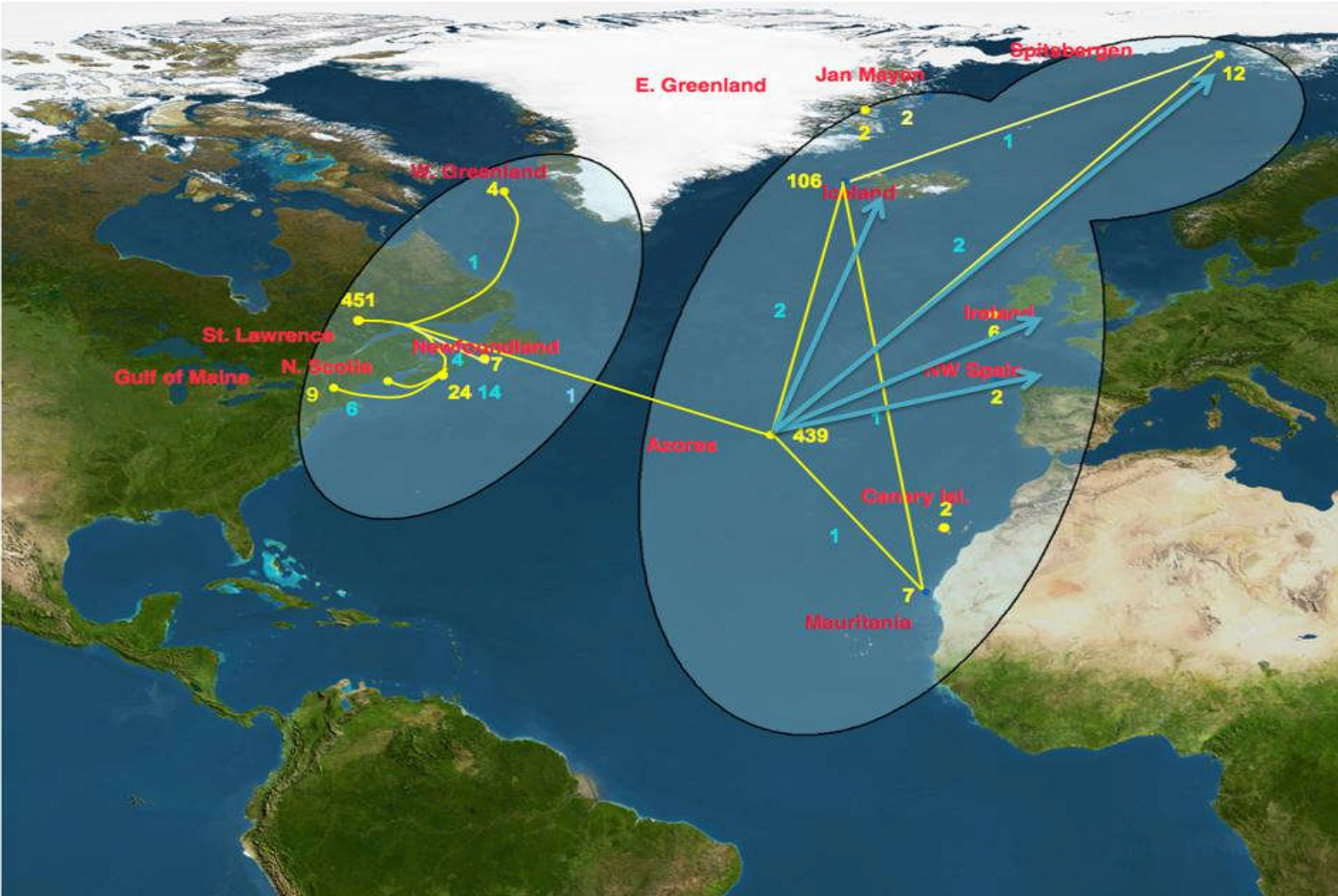


Figure 2.4a. Blue whale movements in the North Atlantic (from Sears et al. 2015). Matches discussed above in turquoise.

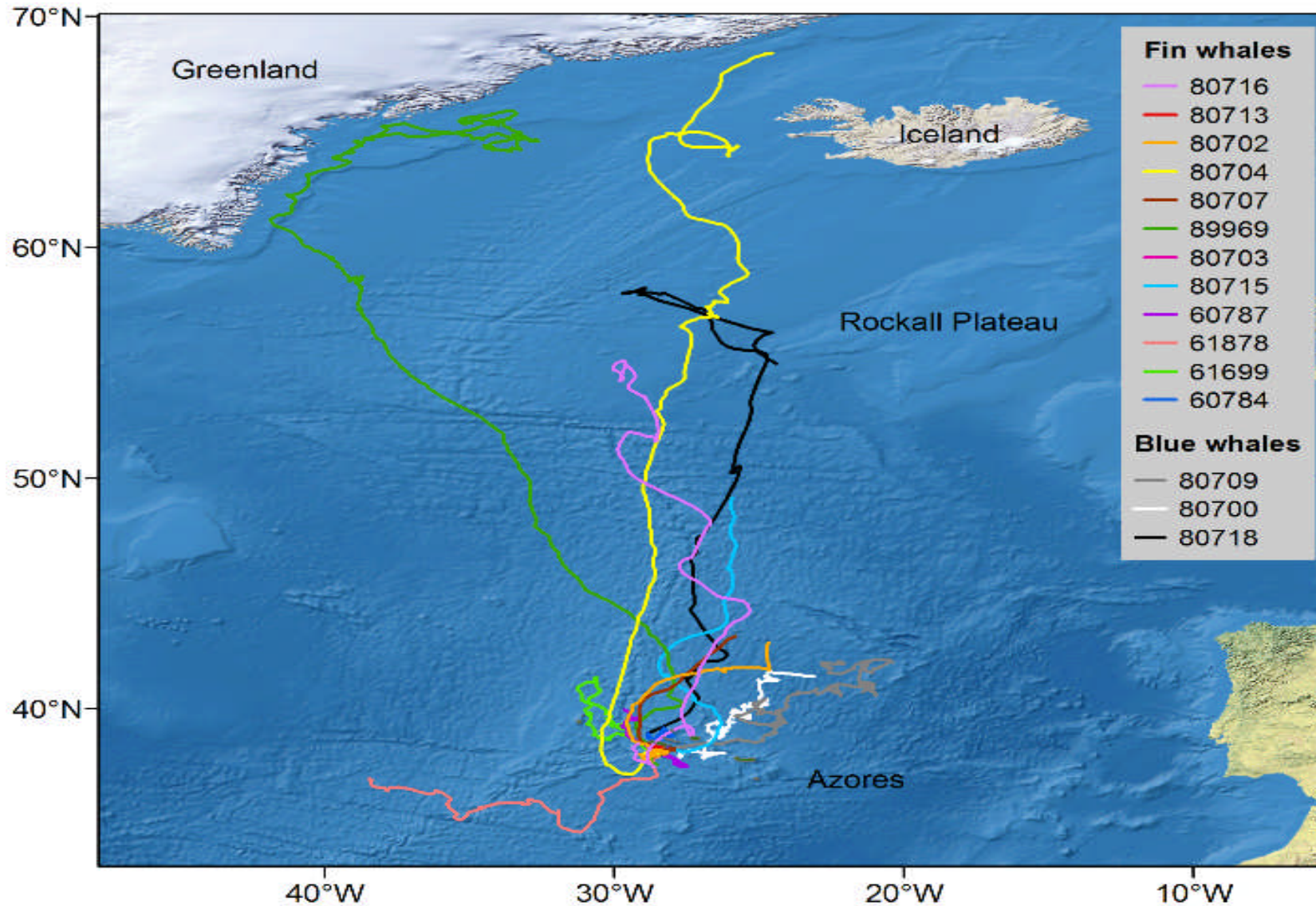


Figure 2.4b. Movement of blue and fin whales tagged in the Azores (Silva et al. 2013).

Further evidence of a distinct East North Atlantic blue whale population comes from other long distance matches from the Azores: two to Iceland and five to Spitzbergen (although not all the author's photos) (Richard Sears, pers comm.). In addition, in 2016 a blue whale was seen in the Bay of Biscay (Northern Spain) that had been previously seen in the Azores earlier in 2016 (Richard Sears pers comm.). There is also a match from the Azores to Ireland. There are also inter-island Azores photos, Sao Miguel – Faial/Pico, as well as the matches between years. There is a 14% yearly re-sighting rate of blue whales from the Azores catalogue (Richard Sears, pers comm.), indicating that at least some individuals use the same route, past the Azores, on their migration. Some individuals spend up to two weeks in the area, feeding, before moving northwards. The amount of time whales spend "snacking" depends on the abundance of "snacks". If there are no krill present, then the animals just pass through. When krill is abundant, they stop off to feed for a while. If the krill is present offshore, there are fewer sightings of animals close to the coast, where we can observe them.

Fin whales

Fin whales were encountered 17 times in 2018. 16 individuals and one pair of whales were recorded. These whales were on their northward migration; exactly where they end up is still a mystery. During the expedition, some initial photo ID matching began with photos taken previously in the Azores and photos of the individuals will be forwarded to a few interested groups in the US and Canada to see if matches can be made, as well as the College of the Atlantic, which currently oversees the humpback whale catalogue. Hopefully some matches will be found. As far as we know, from tags placed on fin whales by the University of the Azores (Figure 2.4b), their general movement is northwards, but the tags stopped working or fell off, before the whales reached the main feeding grounds.

Knowledge of fin whale movements and identification is important, because in the last two years, one Iceland-based company has begun hunting fin whales in order to export the meat to Japan. So it is possible that animals from the Azores migrating to Iceland may face an extra threat in one of their possible feeding grounds.

Humpback whales

The expedition in 2018 encountered five humpback whales. In wider research, outside the expedition, on this species, there have been several humpback whales sighted in the Azores that have also been seen in the Cape Verde Islands (Wenzel et al. 2009). One humpback whale sighted during the expedition matched to a whale previously seen in Northern Norway (in 2014/2015) and close to the Russian border (2016). There has been a new match found from the Azores (not the author's photo) to Newfoundland, which is the first trans-Atlantic match. So it may just be a matter of time before a match is found to the Caribbean population as well. Two animals tagged in Norway a few years ago came close to Faial on their way to the Caribbean, just not close enough to be identified. A new match has also been made recently from the Azores catalogue to Iceland.

Although feeding was not recorded, any feeding at depth would be undetected by us at the surface. After the expedition finished, a few more humpbacks were photographed that matched to Norway. In 2018, there were no matches made to whales that had been seen in the Cape Verde Islands.

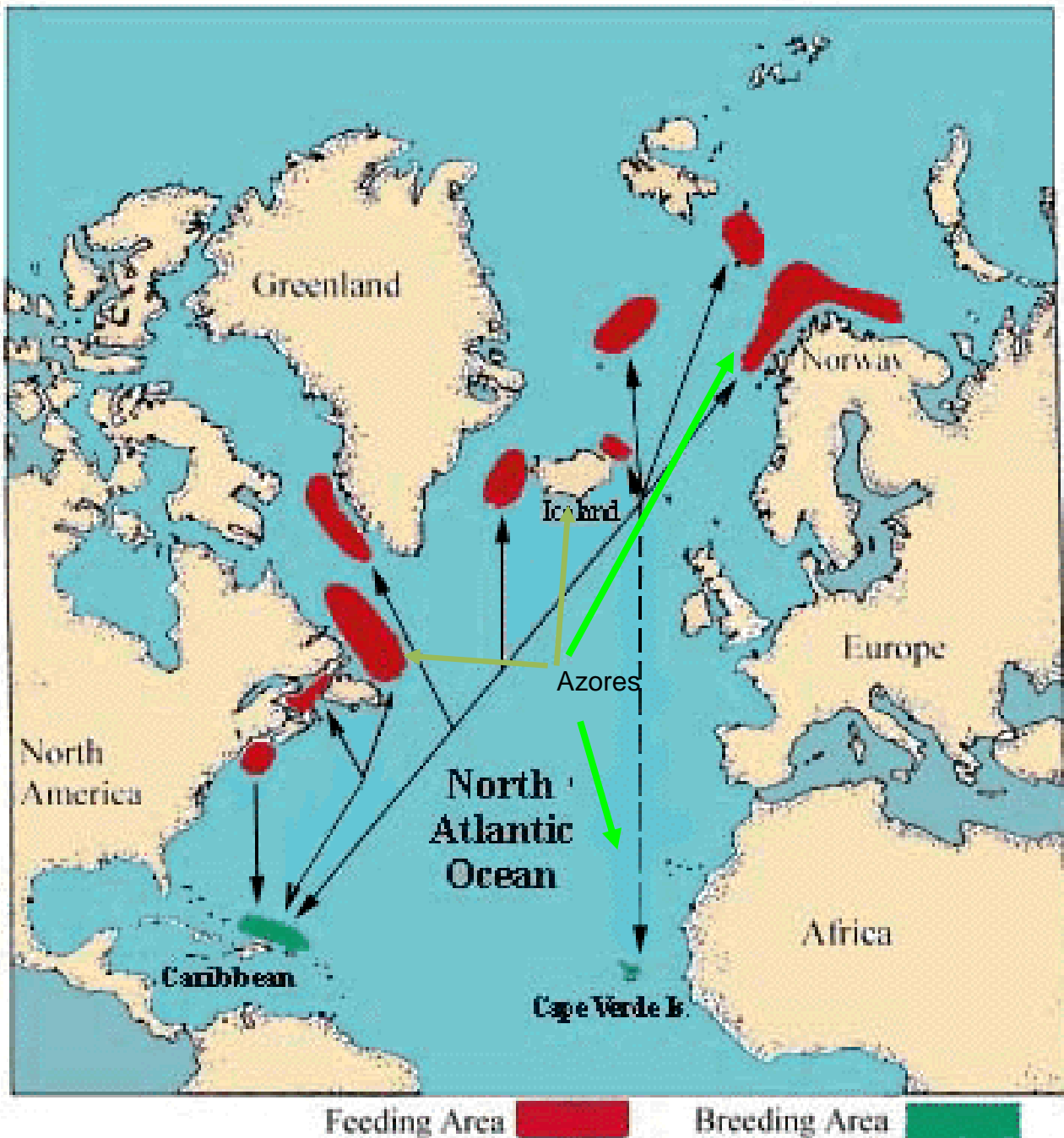


Figure 2.4c. Movement of humpback whales in the North Atlantic (from Wenzel et al. 2009). Azores matches in green.

The North Atlantic Humpback Whale Catalogue is currently approaching 9,000 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 21 ID photos and had one match to the Cape Verde Islands in 2010 and now one to Norway in 2018.

The Cape Verde match made by the expedition, as well as data collected outside the expedition and by other researchers, suggest that 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 (Figure 2.4c). 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

keep an eye on its recovery or decline. Some animals appear to stop in the Azores for a snack on their way to the feeding grounds, as well as on their way back to the breeding grounds and the expedition has made a contribution to this important work. With the match made to Norway, adding to existing matches there, it would appear that many of the Cape Verde animals make their way to Norway as a preferred feeding area.

Most researchers will not risk coming to the Azores to find baleen whales, because their migration patterns are just too unpredictable as seen by the expedition's very variable success in finding them. Researchers could come to the islands for a couple of 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 the expedition's data and continue to tell the author what an important contribution the expedition's baleen whale photos are, since the Azores may be a route marker for animals travelling north (Richard Sears, Peter Stevick, pers comm.).

Two collaborative projects are currently underway with the University of the Azores looking at the sightings of (non-baleen) sperm whales (Boys et al. 2016), as well as the 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 European Cetacean Society conference in Madeira (Chevallard et al. 2016). This corroborated the results mentioned above, i.e. that some blue whales have been seen in multiple years, fin whales have not, and only one Sei whale has been seen in multiple years. Some individual blue and fin whales remain in the Archipelego for a few weeks, while the Sei whales do not.

The significance for whale conservation and research of these findings is that the Azores may provide a crucial 'pit stop' (between breeding grounds further south, possibly Mauritania and feeding grounds in Iceland and Norway) for some of the migrating animals that have not been feeding for a few months on the breeding grounds. The resources that they find in the Azores could make the difference between survival or death. Having a baseline of information on the number of animals and areas that they are using is also useful in detecting any early changes in prey abundance due to global warming.

Dolphin species

Overall dolphin sightings were down on previous years. This was most likely due to the adverse weather conditions the expedition was operating under in 2018, or possibly a lack of food.

The expedition saw resident individuals of both bottlenose and Risso's dolphin although only two groups of each were seen. One of the Risso's dolphin, a well known individual called Resa", was seen during both encounters. She has been seen since 2006 and now has her third calf (K. Hartman pers.comm.). All of the ID photos of the Risso's were forwarded to a biologist who wrote her PhD (Hartman 2014) on Risso's around Pico, for future analysis.

26 groups of common dolphin and two of striped dolphin were also seen. These dolphin are not part of the photo ID project, since group sizes can often be quite large.

Sperm whales

The 2016 expedition had a total of 41 encounters of 72 sperm whales, including females with suckling calves, as has been observed during previous expeditions, as well as a few big males.

Before Biosphere Expeditions began working in the Azores, the expectation was that it will be mainly large males that will be encountered in this early part of the summer, but this has proven not to be the case, although we do tend to see more males in the spring than the rest of the summer. Two different males were seen during this expedition. This year, as usual, they were sighted alone. It is normal for very large males to become more solitary, the older they get, but while they are adolescent they usually associate with other male adolescents in bachelor groups.

Re-sightings of male sperm whales are rare, because they move around looking for female groups to breed with when they are not in their feeding areas, which tend to be further north than the Azores. There have only been a few re-sighted over 30 years. Recently a match was made of a sperm whale seen in the Gulf of Mexico (2002). It was re-sighted in the Azores in 2017. This is the first cross-Atlantic match of a sperm whale.

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) (Steiner et al. 2012). Three males seen in the Azores were matched to animals re-sighted in Norway in 2007 and 2008 (Figure 2.4d). 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 continuing, but none of the males from this year's expedition matched to Norway. The movement of males has now been published (Steiner et al. 2012). Since then another nine males have now been matched from Norway to the Azores. The last match made was a male seen on 9 August 2016, having been seen previously in Norway in 1993, 23 years ago.

Data collected at this time of year are valuable to elucidate if 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 weather in the winter, as well as the difficulty of recruiting citizen scientists for this harsh and challenging time of year, are the main obstacles to investigating this theory.

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. Identification photographs confirm that female sperm whales spend their whole lives together; it is the juvenile males that leave the group. Some of the animals observed in previous years have been seen together for 27 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.

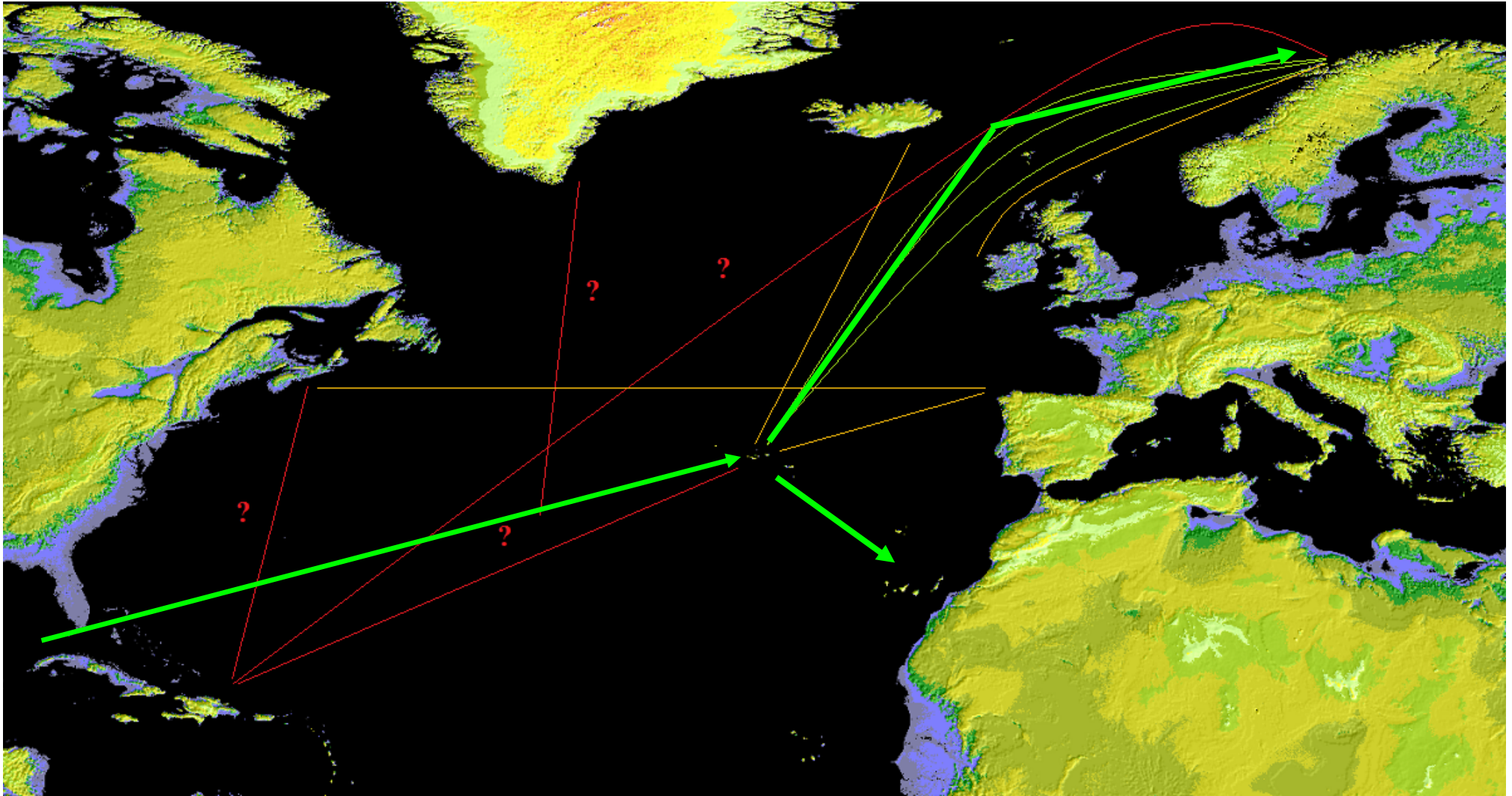


Figure 2.4d. Movements of male sperm whales in the Atlantic (from Steiner et al 2012). Azores matches in green.

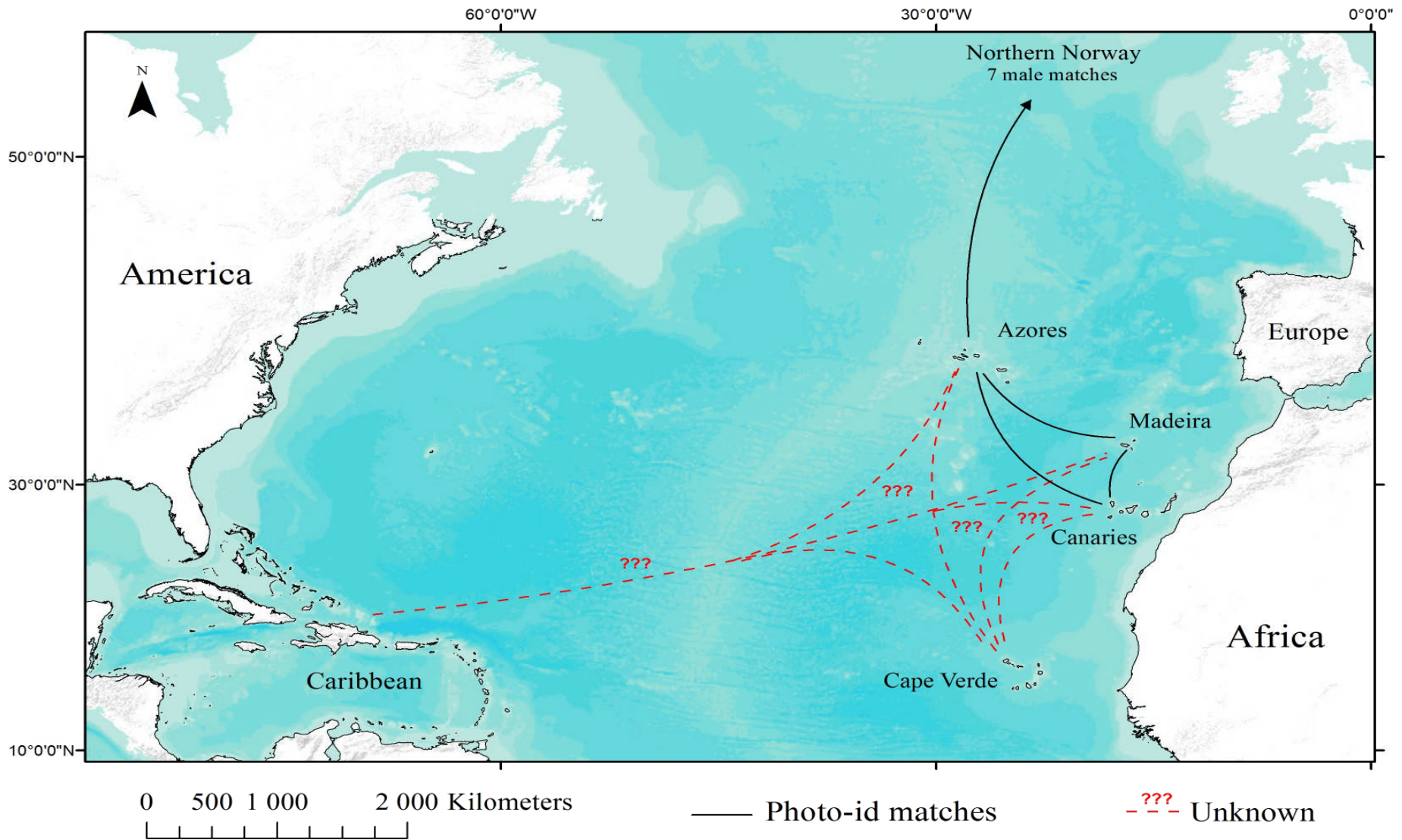


Figure 2.4e. Movements of female sperm whales in the North Atlantic (from Steiner et al. 2015).

We have been collaborating with two whale watching companies that operate out of São Miguel, as well as one of the companies from the south of Pico, for the last couple of years. Several matches exist between the catalogues from the other whale watching companies, indicating that there is some movement of the animals around the archipelago, although most animals have been observed in only one area. The two groups of islands are only 125 nautical miles apart, so it is not surprising that there is movement between the two areas.

In 2011 a collaboration commenced with SECAC (Sociedade para el Estudio de los Cetaceos en el Archipelago Canario, www.cetaceos.org), a research organisation in the Canary Islands. This collaboration has already provided 13 matches for females between the areas. A few of these animals have been sighted in the Azores, seen in the Canary Islands and returned to the Azores. This shows that some female sperm whales undertake at least a limited migration. One of those individuals, “1019”, a whale identified in 1988, was first observed with a calf in 2010. She was photographed in the Canaries with the calf in the winter of 2010/2011 and returned to the Azores with the calf in the summer of 2011. She was again seen in the Canaries winter of 2011/2012 and in 2012 she was back in the Azores, with her calf, which was starting to make independent dives on its own.

As of 2013, the calf, now a juvenile, has not been seen, suggesting that it has not survived independently. The movement of these female sperm whales was presented at the Society for Marine Mammalogy Conference in San Francisco in December 2015, with help from the Friends of Biosphere Expeditions (Figure 2.4e).

An interesting development is that some DNA samples that have been taken from sperm whales in the three archipelagos show distinct differences, indicating that the populations are separate (Monica Silva, pers comm.). Collaboration will continue with other researchers to try and solve this conundrum. It may just come down to sample size. There are not that many groups that have moved between the archipelagos. 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.

In 2009 a PhD by Ricardo Antunes (Antunes 2009) was completed at St. Andrews University, 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 a much longer period of time 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 populations 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. 2011).

Conclusion and outlook

The expedition and its annual reports since 2004 (see www.biosphere-expeditions.org/reports) show the value of long-term studies on cetaceans. There should be some new publications arising from the author's work on sperm whales in the next year or so (a pilot whale study with the author of this report as co-author was published in 2019 – Alves et al. 2019). Initial work (with a paper now under review) has started on using the matching information between islands to work out how often groups of sperm whales move between the central and eastern groups of islands.

In conclusion, this expedition was a success for the fourteenth year. Sightings were good and encounters with baleen and sperm whales kept us occupied with collecting data. More sperm whales than baleen whales were observed and there were not many dolphin sightings. The weather conditions during this year's expedition were poor for a couple of the slots making sightings difficult. Re-sighting individual sperm whales from previous years continues to show the value of the Europhlukes matching programme 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 2019 expedition should:

- continue the photo ID work on the various species.
- continue matching fin whales to confirm if the fin whales visit in multiple years and send to other catalogues around the Atlantic.
- start matching Sei whales to confirm if they are visiting repeatedly, as well as sending images to other catalogues around the Atlantic.
- 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. Maybe even have a dedicated beach clean during the expedition.

Thank you to all expedition members 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 8 March and 19 April 2018 in Faial Island (Azores, Portugal). Onboard of the vessel *Physeter*, citizen scientists had the opportunity to collect information on the marine life of the Azores. During the expedition period, they recorded the occurrence of several marine species such as baleen and toothed whales, dolphins and several species of seabirds (see Figures below). Sightings on surface marine debris were also performed. The information recorded during the expedition will be processed and included in the POPA database (Programa de Observação para as Pescas dos Açores = Azores Fisheries Observer Program).

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 the observers on board the tuna fishing vessels. This database includes information on tuna fisheries (e.g. location of fishing events, catches and fishing effort), weather conditions (e.g. SST, wind and visibility), live bait fisheries (e.g. location of fishing events, catches, gears 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 and since 2016 and is coordinating the Azores nucleus of the ICCAT Atlantic Ocean Tropical Tuna Tagging Programme.

3.2. Results

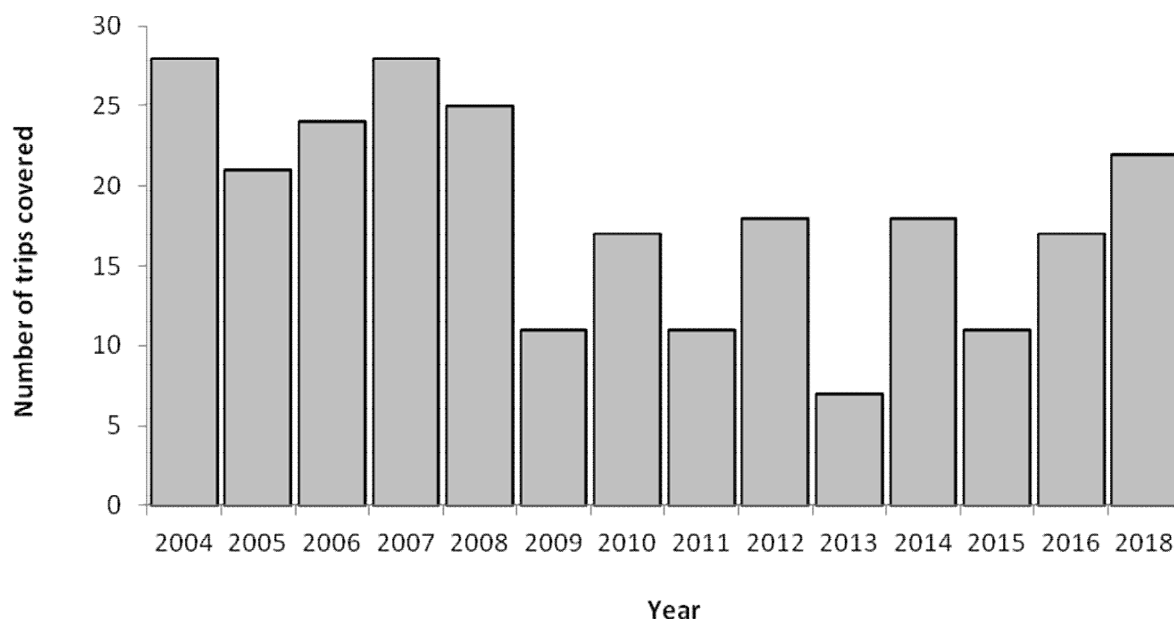


Figure 3.2a. Trip coverage during the 2004-2018 period (there was no expedition in 2017).

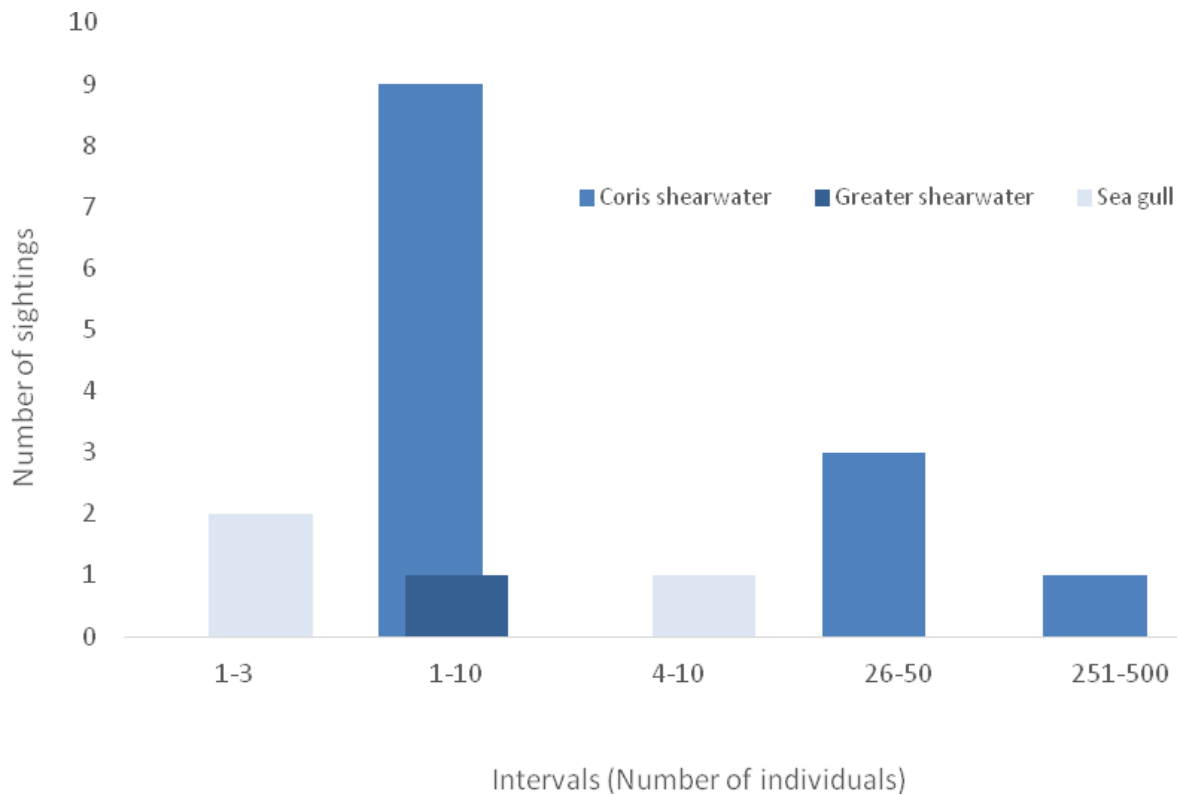


Figure 3.2b. Species of seabirds observed in 2018.

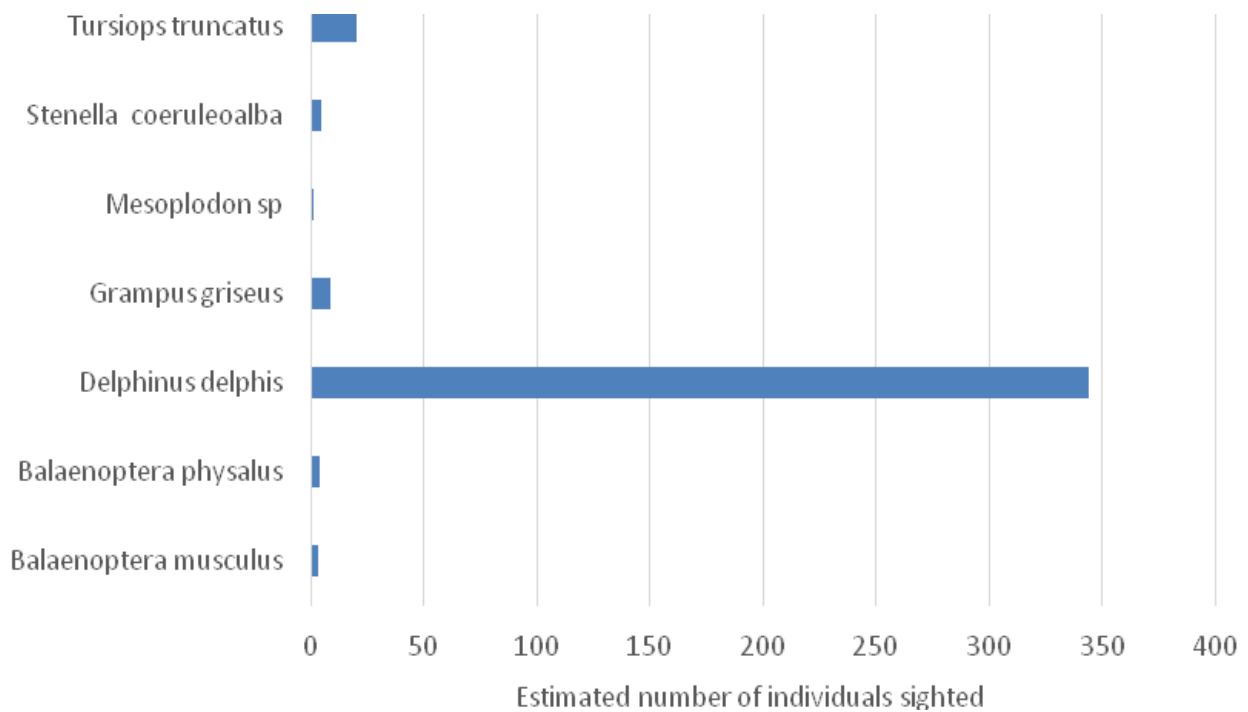


Figure 3.2c. Species of cetaceans observed in 2018.

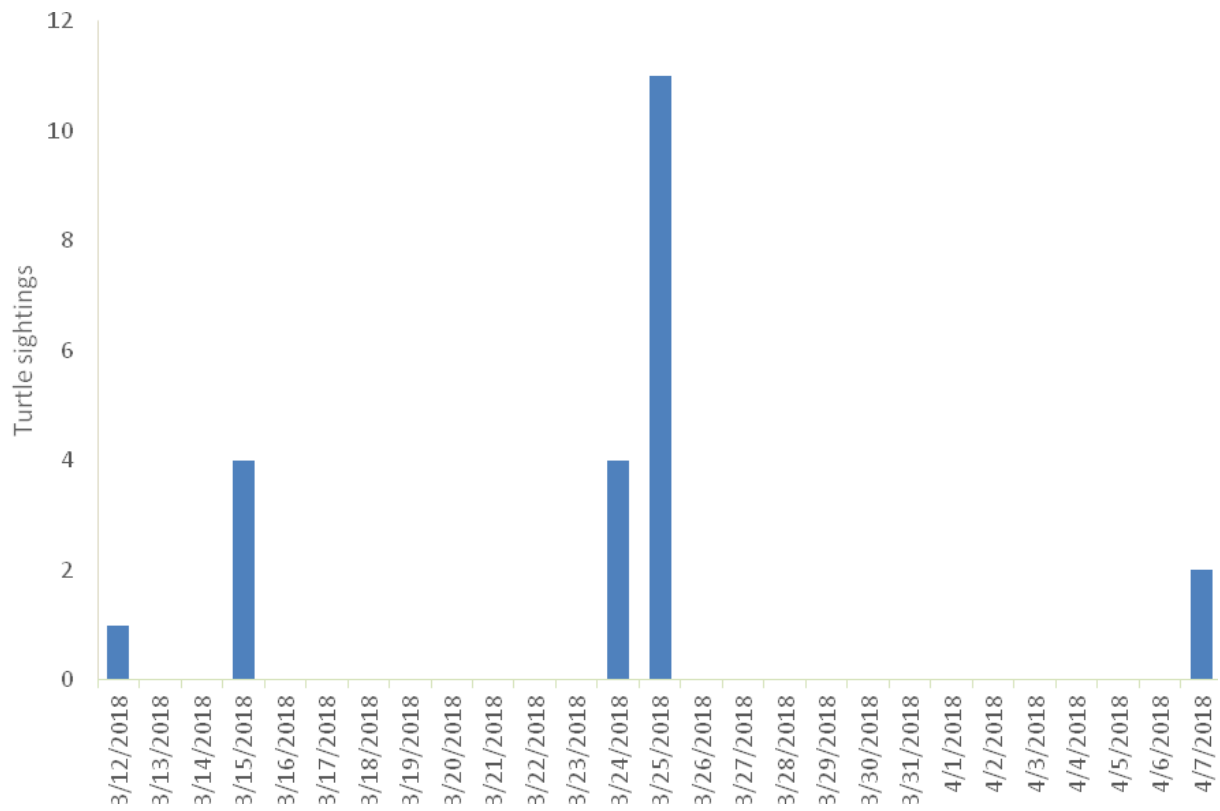


Figure 3.2d. Loggerhead turtles observed in 2018.

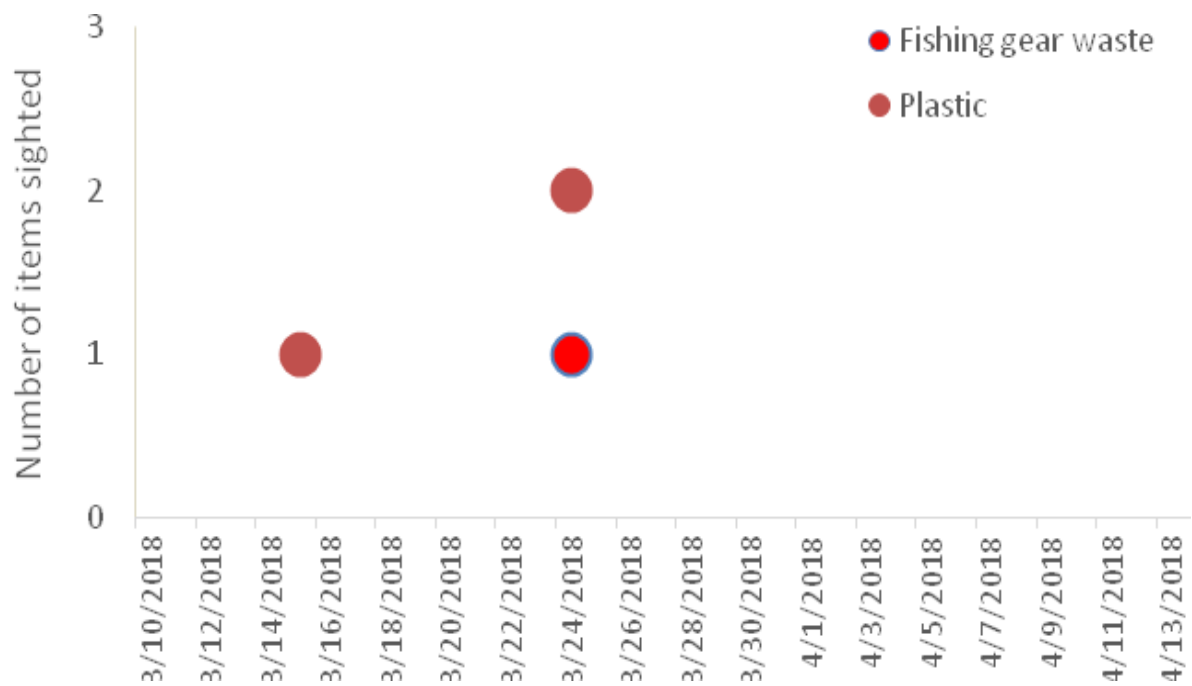


Figure 3.2e. Debris items (5-30 cm) observed in 2018.

3.3. Discussion

POPA has proved that accidental capture of cetaceans in the tuna fishery in the Azores is non-existent with no records of mortality of cetaceans ever reported (Silva et al. 2002, Cruz et al. 2016). But the programme has a much wider significance than just the “dolphin safe” topic. In recent years the POPA dataset (which includes data collected by Biosphere Expeditions) has been frequently requested 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 cetacean interaction with pole and line tuna fishery and spatial/temporal distribution and richness of cetaceans in the mid-Atlantic waters around the Azores (Cruz et al. 2018, Silva et al. 2013, Tobeña et al. 2016). More recently papers on the distribution of marine litter in the ocean were also produced (Chambault 2018). Besides the scientific outputs, the data collected by POPA observers are also available for NGOs, government and to the fishery industry. We thank the Biosphere Expeditions citizen scientists for their contribution to this important database.

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Appendix I: Expedition diary & reports



A multimedia expedition diary is available at <https://blog.biosphere-expeditions.org/category/expedition-blogs/azores-2018/>.



All expedition reports, including this and previous Azores expedition reports, are available at www.biosphere-expeditions.org/reports.