Placement Final Report

Name of Placement Student:	Hannah Hryniszak
Programme of Study:	BSc Marine Biology with Industrial Experience School of Science, Engineering and Environment
Name of Organisation:	University of Salford
Name of Placement Providers:	Sea Trust Wales Society for the Study of Cetaceans in the Canary Archipelago (SECAC)

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Section One: Nature of Placement and Role of the Student

Sea Trust Wales (First Placement Provider)
Duration of Placement: 3rd September 2024 to 27th February 2025
Working Hours: 10am-5pm (four days on, two days off)

Placement Background:
Sea Trust Wales is a marine conservation charity dedicated to researching and raising awareness about the marine environment and local wildlife. They prioritise involving the local community and educating the public when pursuing their conservation goals, believing that a deeper understanding of marine ecosystems leads to a greater desire to protect them. As a result, several of Sea Trust's projects focus on fostering connections and building relationships with local people, including volunteers, residents and tourists.

The porpoise photo ID project is one of the forefront projects at Sea Trust as it is the first photo-identification initiative on harbour porpoises in the UK. Due to the elusive and shy nature of the species, photos are taken on land-based surveys from vantage points around North Pembrokeshire, such as Strumble Head. Markings on porpoises (including notches, scars and pigmentation) are used to identify individuals and build a catalogue of the local population. Estimations of population size can be calculated using the mark-recapture method, allowing long-term monitoring of harbour porpoises in the region and ensuring the population remains abundant and healthy. Data collected as part of this project also informs questions about the ecology of harbour porpoises (such as population dynamics and site fidelity) as well as the environmental factors and human pressures that affect their behaviour and distribution. The research in this project is vital in filling the knowledge gap on harbour porpoises, especially the population in North Pembrokeshire.

Another major component of Sea Trust Wales is their catch-and-release aquarium; it is the main tourist attraction at Ocean Lab (the charity's headquarters) alongside their gift shop and brings in over 7000 visitors each year. The aquarium showcases local marine wildlife, with individual animals kept for no longer than six months before being released back into the wild. Visitors are accompanied by an aquarium guide so they can gain more in-depth knowledge about the species on display, the diversity of marine life in UK waters and have the opportunity to ask questions. In addition, Sea Trust offer seashore safaris – guided rock pooling tours designed mainly for children so they can explore marine life up close.

Ocean Lab also has a free discovery room open to the public as part of the Discover Môr project. This room contains a VR Experience, microscopes, a small children's play corner

and an interactive virtual rock pooling activity – Pwll y Môr. The VR Experience comprises footage from the aquarium and videos shot around Skomer, Skokholm and the Celtic Deep. It talks viewers through local underwater seascapes, providing facts about marine animals such as spider crabs and blue sharks. Pwll y Môr is a photomosaic rock pooling software developed by one of Sea Trust's volunteers, Dr Jon James, which allows users to explore Pembrokeshire's rocky shore online. It's a great tool for people to learn about rocky shore habitats and practice their species ID skills.

Sustainability and conservation are also key priorities for Sea Trust; one of their projects Recycle Môr tackles marine plastic pollution. Through the installation of recycling bins in seven harbours across Pembrokeshire (including Lowertown Fishguard, Saundersfoot and Tenby), fisherman have a free disposal method for their end-of-life fishing gear. This waste is collected and sorted by staff at Sea Trust before being picked up by a Cornish company called Waterhaul who process and recycle the plastic into reusable products. Additionally, Sea Trust is committed to creating a more eco-friendly building; solar panels have recently been installed to reduce Ocean Lab's carbon footprint. Furthermore, a community garden comprising of drought- and pollinator-friendly plants and a bug hotel has been built as part of the Gardd y Môr project. Its purpose is to provide a place to connect with nature and raise awareness about the importance of pollination and the effects of climate change.

Education and outreach play a crucial role in Sea Trust's work as a charity. They collaborate with schools around Pembrokeshire, delivering presentations on local marine wildlife and hosting school visits at Ocean Lab. Since sessions are delivered to all ages, from primary school to sixth forms and colleges, they are tailored depending on year group and align with topics that students are currently studying in the curriculum. Sea Trust also run a weekly Marine Biology Club for ages 10-17. The children are taught about marine species and ecosystems through a range of activities, from arts and crafts to rock pooling, which cements their learning and fosters a deeper connection to the marine environment.

Contact Information and Other Details:

Address	Ocean Lab, The Parrog, Goodwick, SA64 0DE Pembrokeshire, Wales, United Kingdom
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Telephone Number	01348 688588
Website	https://www.seatrust.org.uk/
Placement Supervisor	Nadia Tomsa, Projects Manager nadia@seatrust.org.uk

Duties and Responsibilities:

Porpoise Photo ID Project:

- Conduct cetacean surveys – finding porpoises and other cetaceans with the aid of binoculars and recording observations on survey forms.
- Weekly data entry of survey forms and photos taken – inputting survey data into the porpoise Excel file and transferring all photos from the camera onto the research hard drive, organising them in folders according to date taken.
- Photo processing and matching – there are three stages to photo processing; first, any photos that don't include a porpoise or are not sufficient quality are deleted. For each survey, the number of photos taken and analysed are recorded in the porpoise Excel file. Marked porpoises are sorted into folders and identified using the matrix and catalogue.
- Updating identification matrix and catalogues with new individuals and re-sightings – when marked individuals are matched against a porpoise already catalogued, the matrix and catalogue are updated with the new sighting. If the marks on a porpoise are clear enough and they don't match previous individuals, they are catalogued as a new individual, given a name and description and all markings are recorded.
- Survey equipment cleaning and maintenance – binoculars, cameras and tripods are wiped down weekly to prevent water and salt damage.
- Social media updates – posting monthly sightings, marine mammal fact files, survey updates, etc. and writing the monthly 'Adopt a Porpoise' newsletter.

Aquarium:

- Being an aquarium guide – guiding visitors around the aquarium, offering knowledge on local Pembrokeshire wildlife, species on display and Sea Trust's projects, and answering any questions.
- Daily animal health and temperature checks – recording the temperature of each tank and checking on the animals within them before the aquarium opens.
- Feeding the tanks – tanks are fed twice every day with phytoplankton, rotifers and brine shrimp, and animals are fed once with mysis shrimp or bigger food varying from prawns to fish or squid.
- End of day checks – before leaving the aquarium, checks are conducted to ensure tank filters and air supplies are on, tank lids are closed and food is put away.
- Tank maintenance – includes changing tank water, cleaning filters and testing tank water to ensure it's healthy (usually conducted on a weekly basis, every Friday).
- Rock pooling for display species and live food.

- Organising and tidying – cleaning up after completing daily/weekly tasks, making sure equipment is clean and tidy, and keeping shelves and workspaces organised.

Recycle Môr:

- Collecting end-of-life fishing gear – gathering end-of-life fishing gear from recycling bins located in seven harbours across Pembrokeshire and transporting them back to Ocean Lab to be sorted.
- Separating and weighing waste – separating waste into different gear types (such as bait bags, unleaded rope and hard plastic), weighing them and then recording their weight along with the date and harbour they were collected from.
- Data entry, analysis and display – entering data into an Excel file and creating tables and graphs to communicate how much end-of-life gear has been recycled and the impact of the project.

Gardd y Môr:

As this project launched during my placement, I was a leading contributor and was solely responsible for:

- Gathering information on Gardd y Môr, drought-friendly plants and the impacts of climate change.
- Designing two garden signs – using Canva to create size-accurate templates, adding graphics, photos and text to the designs, and editing layout and colour scheme to ensure they were attractive and accessible for all viewers.

Education and Outreach:

- Presenting at school visits – delivering presentations on marine wildlife, threats to the ocean, rockpool species ID, how to use Pwll y Mor and setting up students on the VR headsets (depending on the session).
- Assisting with school groups visiting Sea Trust – presenting to and supervising school groups during onsite visits or surveys at Strumble Head.
- Hosting Marine Biology Club sessions – planning and delivering sessions to Marine Biology Club members.
- Preparing educational aides and activity sheets – using the graphic design platform Canva to create children's activity sheets, information packs, and more.

Other General Intern Duties:

- Front desk duties – checking visitors in with the online booking system, manning the till, processing deliveries and updating the inventory with new stock.

- Ensuring Ocean Lab is clean and tidy – hoovering and other cleaning tasks.

Section Two: Placement Project and Scientific Report

Common Dolphin Seasonality in North Pembrokeshire, UK: Trends and Changes Over Recent Years

Abstract

Common dolphins (*Delphinus delphis*) are one of the UK's most abundant cetaceans and are frequently seen around Pembrokeshire, however there is a lack of knowledge on their distribution. This project aims to uncover the seasonal trends in common dolphin presence and how patterns have changed in recent years. Sea Trust have conducted land-based surveys across seven years recording common dolphin presence from 2018 to 2024. Although results suggest that common dolphin abundance peaks in North Pembrokeshire in January, February, July and August, inferential analysis concluded differences between months were not statistically significant. However, sightings have significantly increased from 2018 to 2024, with a dramatic rise in 2022 and again in 2024, suggesting that common dolphins are experiencing range expansion with rising temperatures and are frequenting North Pembrokeshire more often as a result. Continued monitoring of common dolphins in this region is essential to gain a fuller and more accurate understanding of their abundance and distribution. Analysis of factors like sea surface temperature and prey distribution should also be conducted to determine their influence on common dolphins.

Introduction

1.1. Common Dolphins as a Species

The common dolphin (*Delphinus delphis*) is a small cetacean species which belongs to the Suborder Odontoceti and the Family Delphinidae. Odontocetes are toothed whales which utilise echolocation for navigation, orientation, communication, and, most importantly, to locate prey (Nieder et al., 2022; Moss et al., 2023; Ansmann, 2005). Delphinids are also known as the 'true dolphins' as they inhabit oceanic waters; they are the most diverse family of cetaceans in terms of size and diet with 37 extant species ranging from orcas, *Orcinus orca* to Hector's dolphins, *Cephalorhynchus hectori* (Fordyce, 2018; Jefferson & LeDuc, 2018).

The general characteristics of delphinids include a slender body, rounded head and a tall, arched fin, however common dolphins have a unique colouration which makes them quite distinctive and easily recognisable from other species (Jefferson & LeDuc, 2018; Reid et al., 2003). They have an hourglass-shaped pattern on their lower flanks with a yellow-cream colour anterior to the dorsal fin and lighter grey-white in the posterior section (Jefferson & LeDuc, 2018; Reid et al., 2003; Pujol-Soliano, 2018; Halicka, 2015). Common dolphins have

a relatively short lifespan of approximately 22 years and they reach an average length of 210cm, although this differs depending on the region (Halicka, 2015; Reid et al., 2003; Pujol-Soliano, 2018; Carwardine, 2022; Murphy et al., 2013). They also exhibit sexual dimorphism with males having a larger body length and other morphological features in comparison to females (Pujol-Soliano, 2018; Murphy et al., 2013; Chivers, 2018).

Common dolphins are gregarious animals, living in pods ranging from ten to thousands of individuals (Halicka, 2015; Braulik et al., 2021; Dans et al., 2022). They are highly social and communicate acoustically through noises like whistles, clicks and barks (Ansmann, 2005: Pagliani et al., 2024).

Furthermore, common dolphins have been observed in mixed cetacean groups, travelling and feeding with odontocete and mysticete species (Frantzis and Herzing, 2002; Ansmann, 2005; Syme et al., 2021). In fact, Syme et al. (2021) found that they are the second most frequently observed cetacean in mixed-species groups with 27 partner species including striped dolphins (*Stenella coeruleoalba*), Risso's dolphins (*Grampus griseus*), and fin whales (*Balaenoptera physalus*).

1.2. Distribution and Ecology

Common dolphins are a widely distributed, oceanic species which inhabit waters between 40-60°N and approximately 50°S (Ansmann, 2005; Reid and Evans, 2003; Halicka, 2015). They live in temperate and tropical waters in the Atlantic, Pacific and Indian Oceans as well as the Mediterranean and Black Seas (Braulik et al., 2021; Murphy et al., 2021; Paradell et al., 2019). They are one of the most abundant cetaceans in the North Atlantic Ocean with their current range extending from the Canary Islands to Scotland and the west of Norway (MacLeod et al., 2008; Pujol-Soliano, 2018; Correia et al., 2019; Murphy et al., 2013; Peltier et al., 2016).

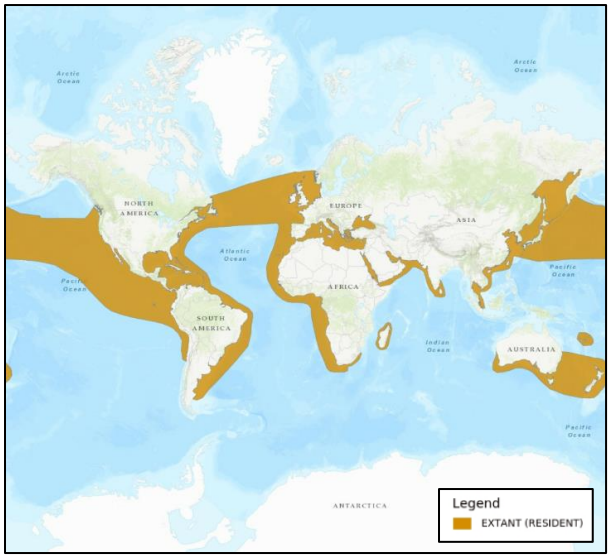

Figure 1: Worldwide distribution of common dolphins. Note. Adapted from Braulik et al. (2021).

Although they live in a range of habitats, studies have found common dolphins prefer areas of high productivity, mainly continental shelfs and upwelling regions (Correia et al., 2019; Braulik et al., 2021; Murphy et al., 2021; Paradell et al., 2019). This is because high primary productivity, often measured in terms of chlorophyll concentration, is associated with a higher occurrence of pelagic schooling fish – the main prey component of common dolphins' diet (Moura et al., 2012; Correia et al., 2019; Halicka, 2015). As their diet mainly comprises of small, schooling, pelagic fish, common dolphins are classed as ecological specialists (Correia et al., 2019; Pujol-Soliano, 2018; Dans et al., 2022). Despite their diet being

specialised to this prey type, common dolphins are opportunistic feeders and hunt any species of small schooling fish, although they usually target the most abundant in the region (Moura et al., 2012; Murphy et al., 2013; Correia et al., 2019). Stomach analysis of common dolphins across the North Atlantic Ocean reflected an abundance of similar fish species, the most common being sardine (*Sardina pilchardus*), horse mackerel (*Trachurus trachurus*) and blue whiting (*Micromesistius poutassou*), however the primary prey item consumed did differ between regions and years (Milani et al., 2019; Murphy et al., 2013).

Furthermore, sea surface temperature and depth influence common dolphin distribution due to their association with primary productivity and prey distribution (Neumann et al., 2001; MacLeod et al., 2008; Correia et al., 2019). Correia et al. (2019) found that common dolphins prefer colder waters within their range, presumably because they are an indicator of upwelling phenomena, productivity and therefore the presence of prey.

However, common dolphins are a warm water limited species, meaning that their range is restricted by their ability to occur in the cooler waters at the higher latitudes of their range (MacLeod et al., 2009; Lambert et al., 2011). Currently, common dolphins have the North Atlantic Ocean as the northern cold limit of their range (Lambert et al., 2011). Cañadas et al. (2009) determined that common dolphins prefer temperatures above 15°C although the exact reasoning is unknown. Multiple hypotheses have been presented: that cetaceans are physiologically limited by temperature and the energy costs of keeping insulated, that their range is determined by the distribution of their prey, and that competitive interactions driven by water temperature define the edges of their range (Lambert et al., 2011; MacLeod et al., 2009).

1.3. Common Dolphins in the UK, specifically North Pembrokeshire

The range of common dolphins around the UK extends upwards across the west coasts of Britain and Ireland, from the western English Channel to the Inner Hebrides and currently excludes most of the North Sea (Pujol-Soliano, 2018; Ansmann, 2005). In Welsh waters, they are most abundant in the southern Irish Sea over the Celtic Deep and off the west coast of Pembrokeshire (Pujol-Soliano, 2018; Baines and Evans, 2012). Coastal locations around North Pembrokeshire are classified as shelf edge waters due to their proximity to the Celtic Deep, which is a deep-sea pan in the Celtic Sea continental shelf. They are characterised by strong tidal currents and upwelling, and the mixing of stratified water at the Celtic Sea Front means that the environment is highly dynamic (Iyer et al., 2013; Goold, 1998; Correia et al., 2019; Pujol-Soliano; 2018). Thus, there are high levels of primary productivity and a subsequent high abundance of small, pelagic schooling fish, making it an ideal habitat for common dolphins (Correia et al., 2019; Goold, 1998; Pujol-Soliano, 2018).

Despite common dolphins being frequently sighted and called one of Pembrokeshire's 'big five' by Sea Trust Wales, there is a lack of research into their distribution and behaviour in the county, as well as Wales and the UK as a whole. Little is known about their abundance and movements in the Celtic and Irish Seas. Their last population estimate was 37,000 in 2004, however the confidence interval ranges from 20,000 to 210,000 dolphins (Paxton et

al., 2011). The high uncertainty surrounding common dolphin abundance in the Celtic Sea stems from low survey effort; therefore, this project is vital to gain insight into the common dolphin population and to understand more about their abundance, distribution and dynamics.

1.4. Seasonality in Distribution of Common Dolphins

In the context of this study, seasonality can be defined as the annual, periodic changes in a species' movement or behaviour. Many studies have found evidence which suggests that common dolphins do exhibit seasonality in their distribution; for example, in New Zealand, Neumann (2001) identified a trend in offshore movement of common dolphins between September and April. In the northern Aegean Sea, there is a higher encounter rate of common dolphins in autumn despite survey effort being higher in summer (Milani et al., 2019). Moreover, Correia et al. (2019) investigated common dolphin distribution around mainland Portugal and the Macaronesia archipelagos and recorded the most sightings in July and October, although they did acknowledge this could be a result of higher survey effort during those months. However, another study focusing on the south Maderia Islands (located in Macaronesia) also found higher occurrences of common dolphins from autumn to early spring suggesting they do exhibit seasonality in this area (Halicka, 2015).

Within Welsh waters, there has been little research performed into common dolphins and their seasonality with currently under ten publications on the topic. Two studies suggest that common dolphins are mainly summer visitors to the Pembrokeshire coastline as the highest abundance rates are recorded in summer with a noted decrease in sightings from December to April (Pujol-Soliano, 2018; Baines and Evans, 2012). Likewise, Goold (1998) discovered an offshore autumn migration during September/October which aligned with the breakdown of the Celtic Sea Front, suggesting their absence along the coast in winter is due to lower prey availability. In direct contrast, Paxton et al. (2011) reported common dolphin abundance peaks in autumn with an earlier peak in May and June. This juxtaposition highlights a desperate need for increased survey effort in this region so that a reliable view of common dolphin seasonality in the Celtic Sea can be determined without the influence of any bias from survey inconsistencies.

1.5. Conservation Threats and Concerns

Although their global population is categorised as Least Concern by the IUCN Red List for Threatened Species, common dolphins experience a variety of threats including bycatch, prey depletion, noise pollution and contaminants (Braulik et al., 2021; Murphy et al., 2013; Pujol-Soliano, 2018; Murphy et al., 2021). They also experience differing levels of pressure based on region with the Black Sea and Mediterranean sub-populations being most at risk, categorised as Vulnerable and Endangered respectively by the IUCN Red List (Braulik et al., 2021).

Bycatch is perhaps the most significant threat affecting common dolphins as they are the most frequently bycaught dolphin in the Northeast Atlantic Ocean (Cañadas et al., 2009;

Murphy et al., 2013; de Boer et al., 2012). They are subject to entanglement in driftnets and gillnets, trawl nets, long-lines and seine nets which often results in serious injury or death (Murphy et al., 2009; Braulik et al., 2021; de Boer et al., 2012). High levels of bycatch are often reflected in cetacean strandings and their subsequent cause of death investigations. For example, in cases where cause of death could be determined, the majority of common dolphin strandings along the Welsh coast have been attributed to entanglement in fishing gear, emphasising the severity of the issue of bycatch in the Celtic Sea (Baines and Evans, 2012). Furthermore, Peltier et al. (2016) investigated common dolphin bycatch rates from strandings in the Bay of Biscay and estimated that, on average, between 3600 and 4700 dolphins were caught as bycatch each year over the 19-year study period.

Another threat is prey depletion as a result of overfishing, which is particularly evident in the Mediterranean Sea, and is considered one of the primary causes of regional common dolphin declines in Spain, Italy and Greece (Moura et al., 2012, Braulik et al., 2021). Due to the ecological specialisation of common dolphins, regarding both habitat and diet, they are especially vulnerable to extinction debt following overexploitation (Moura et al., 2012). Extinction debt is characterised by an apparent resistance to habitat disturbance but is later followed by a population crash once the habitat reaches a new state of equilibrium (Moura et al., 2012; Kuussaari et al., 2009). The potential risk for common dolphins is exacerbated by their life history traits (such as long generation times and low reproductive rates) as it will take them longer to recover from such a drastic population decline (Moura et al., 2012; Kuussaari et al., 2009; Chivers, 2018; Chen et al., 2022). Moreover, the undernourishment caused by reduced prey availability increases dolphins' susceptibility to viral infections and has been correlated with common dolphin die-offs (Birkun, 2008).

1.6. Implications of Climate Change for Common Dolphins

Another conservation concern for common dolphins is climate change and the future implications it will have on the species. As sea surface temperature significantly impacts their distribution and common dolphins are a warm water limited species, their geographic range is expected to expand with rising temperatures (MacLeod et al., 2008; Correia et al., 2019; Neumann et al., 2001; Lambert et al., 2011; Murphy et al., 2009). Northward range expansion of common dolphins has already been recorded in the North Atlantic Ocean and is expected to continue (Lambert et al., 2011; van Weelden et al., 2021). Although there are some benefits correlated with range expansion such as increased habitat and access to new food resources, there are also novel challenges associated with tracking into a new environment (Lambert et al., 2011; MacLeod et al., 2008; van Weelden et al., 2021). For example, bycatch is the largest threats to common dolphins in the UK (de Boer et al., 2012; Murphy et al., 2009). As common dolphins expand their range in the Northeast Atlantic, they may travel to areas outside of current conservation regulations, putting the animals at risk of bycatch (de Boer et al., 2012; Lambert et al., 2011; Pujol-Soliano, 2018; MacLeod et al., 2008). Therefore, monitoring changes in common dolphin distribution is very important for the species' conservation as it allows for more dynamic and adaptive management approaches, opposed to the typical reactive measures (Lambert et al., 2011; Murphy et al., 2021; van Weelden et al., 2021).

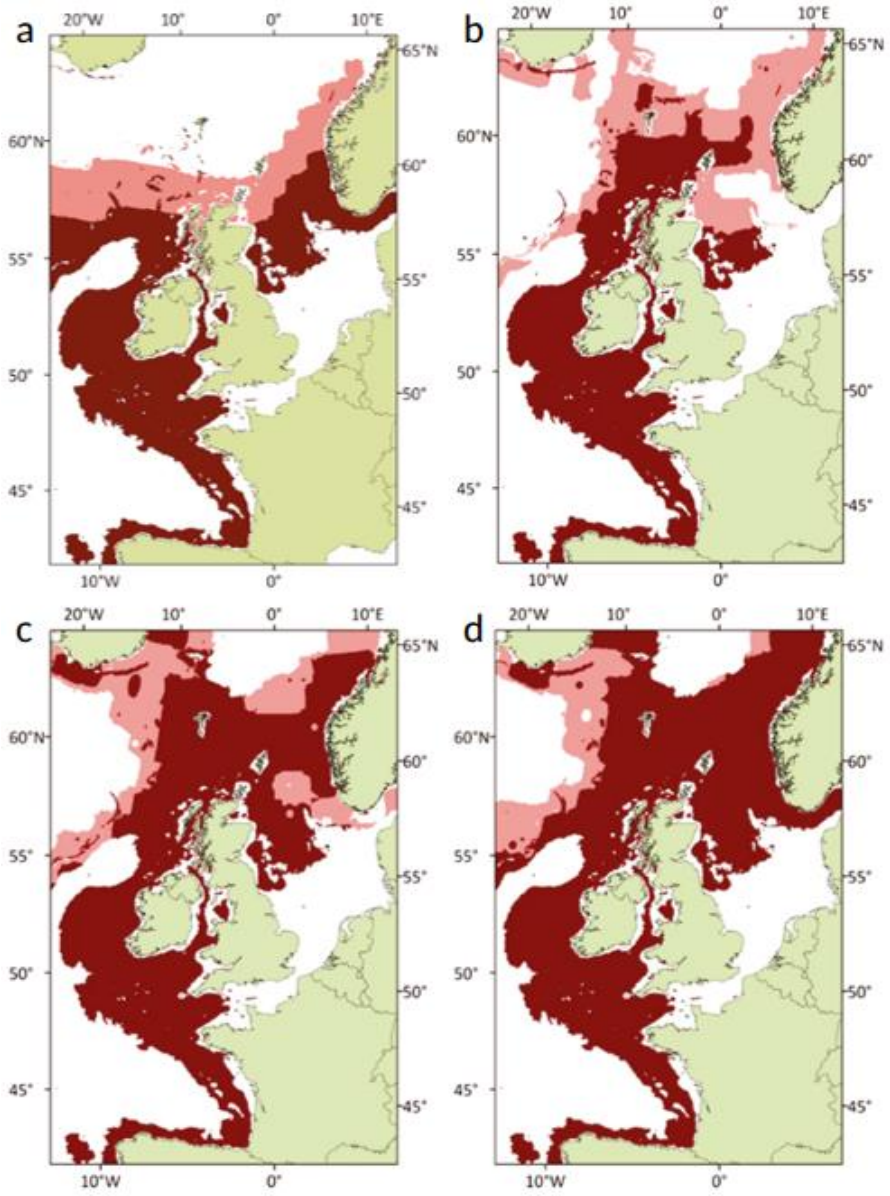

Figure 2: Predicted range of common dolphins in northwest Europe for (a 2000-2008), (b) 2020-2029, (c) 2040-2049, and (d) 2060-2069.
Note. Adapted from Lambert et al. (2011).

1.7. Aims, Objectives and Rationale of Study

This project investigates temporal variation in common dolphin presence and distribution in North Pembrokeshire between 2018 and 2024. There are two research objectives as part of this project; firstly, does the presence of common dolphins vary between seasons in North Pembrokeshire? And secondly, are the number of common dolphin sightings in North Pembrokeshire increasing over time?

H_1: There is significant seasonal variation in common dolphin sightings.

H_2: The number of common dolphin sightings per unit effort have increased from 2018 to 2024.

Materials and Methods

The data for this project on common dolphins is taken from an existing Sea Trust Wales project and spans from January 2018 to December 2024. Whilst that project focused on harbour porpoises, common dolphin presence was also recorded during surveys alongside behaviour and estimated group size.

Across North Pembrokeshire, there are four survey sites used by Sea Trust Wales for data collection: Strumble Head, Pen Anglas, Fishguard Harbour Outer Breakwater and Ramsey Sound. They are open for the public to access so no permits were required for fieldwork to take place. Furthermore, due to the non-invasive nature of the chosen survey technique, there were no ethical concerns associated with this project.

Figure 3: Four survey sites across North Pembrokeshire.

All surveys were land-based and cetacean observations were made with the naked eye and with the aid of binoculars. Surveys were conducted four times a week, however they were subject to weather conditions; extreme rain, snow or wind could mean a survey was cancelled or cut short. They lasted for a maximum duration of two hours and the start and end times of each survey were recorded as well as high and low tide times and height, sea state, wind direction, visibility, cloud cover and precipitation.

To combat inconsistency between surveys, sightings per unit effort (SPUE) was calculated for each month and each year to aid in comparisons. The dataset was formatted using Excel and then inputted into R for analysis. Inferential statistical tests were used to analyse the significance of the data; since the data was not normally distributed and ordinal data was being tested, a Kruskal-Wallis chi-squared test was used to determine whether there was a significant difference in sightings per unit effort (SPUE) values across months and across years of the study. Regression statistics were also utilised to determine the slope and direction of the linear trend in common dolphin sightings per unit effort across years.

Results

Although descriptive statistics display two peaks in common dolphin sightings (the largest in January and February and another in August and September), statistical analysis found no significant difference in common dolphin presence between months in this study (Fig. 4; *Kruskal-Wallis chi-squared = 16.934, p-value = 0.1098*).

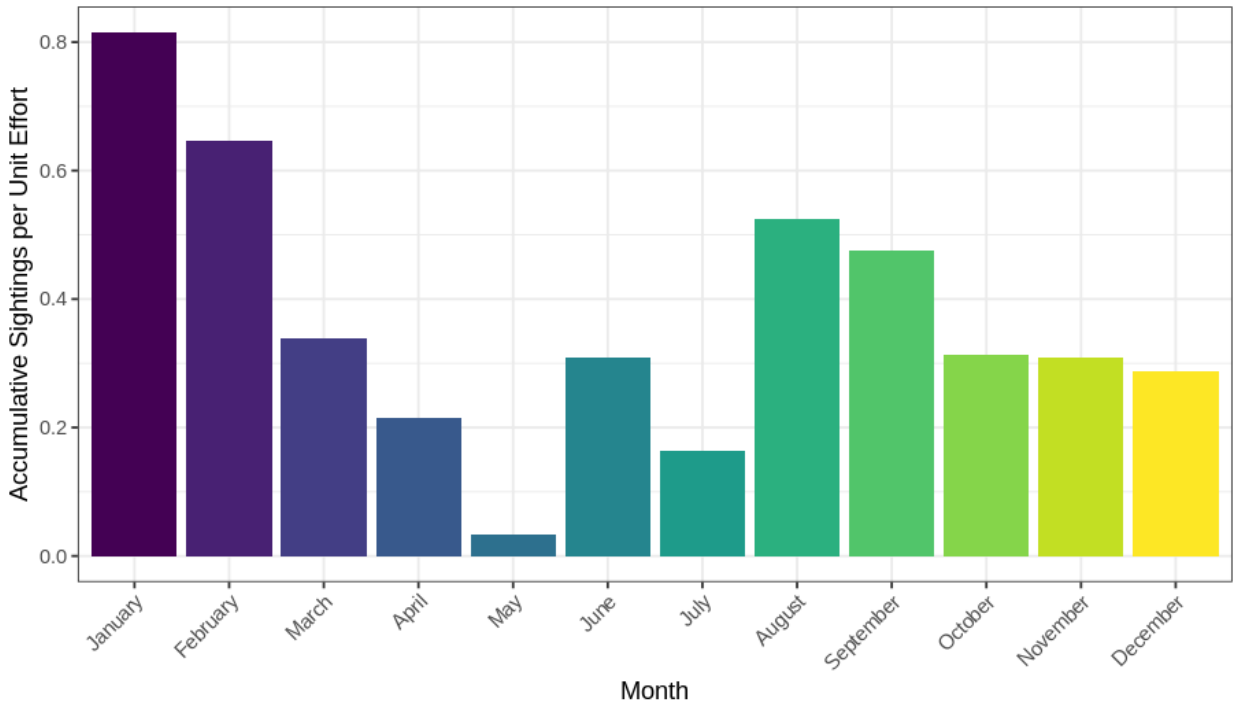

Figure 4: Accumulative monthly sightings per unit effort from 2018 to 2024.

Despite there not being a statistically significant monthly or seasonal variation in common dolphin sightings, there is a significant increase in sightings per year from 2018 to 2024, at a 99.9% confidence level (*Kruskal-Wallis chi-squared = 31.167, p-value < 0.01*). Moreover, regression statistics demonstrate a positive trend, reinforcing that sightings of common

dolphins have hugely increased from 2021 to 2022 and again from 2023 to 2024 (Fig. 5; R^2 = *0.796*).

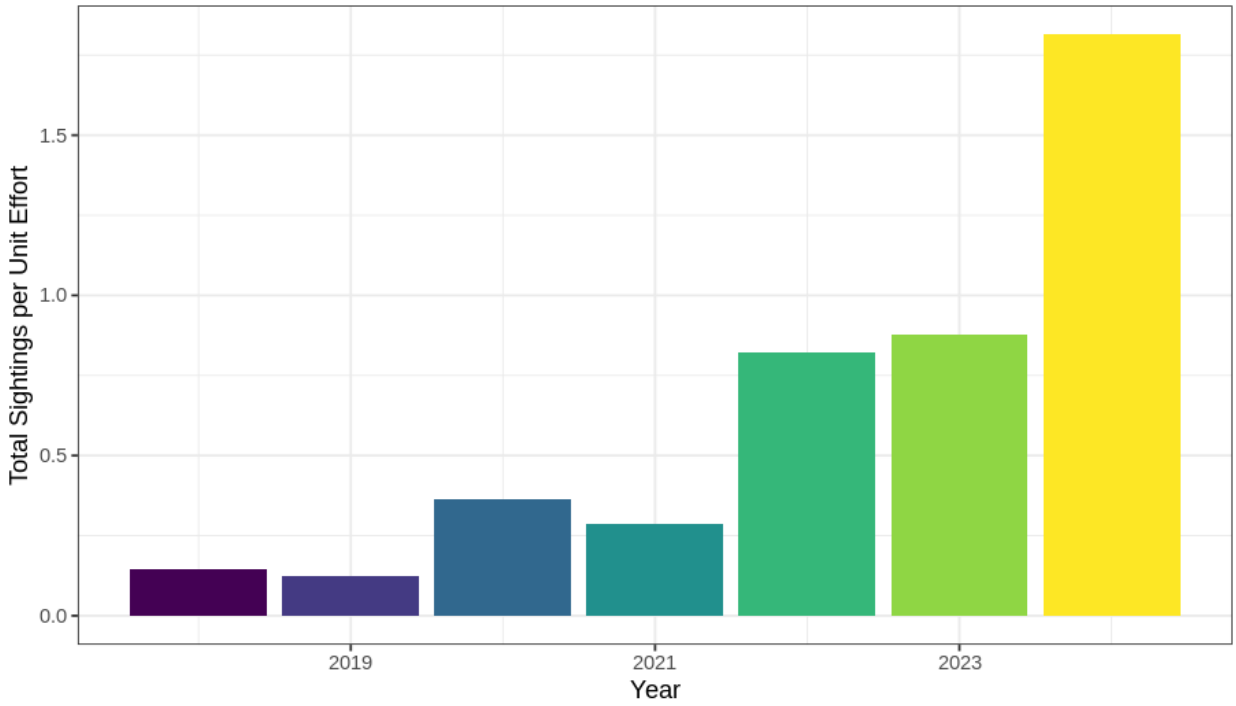

Figure 5: Total sightings per unit effort for each year of the study period.

In addition, the number of months in which common dolphins have been sighted each year has increased, as well as the overall number of annual sightings per unit effort (Fig. 6). To clarify, between 2018 and 2020, common dolphins were only recorded four or five months of the year. This number rose to nine months in 2021 and 2022 and increased to eleven in 2023 and 2024, leaving May and December, respectively, as the only months without any common dolphin sightings. This could indicate that common dolphins are becoming year-round residents in North Pembrokeshire and the Celtic Sea rather than summer visitors, as suggested by previous literature (Baines and Evans, 2012; Goold, 1998).

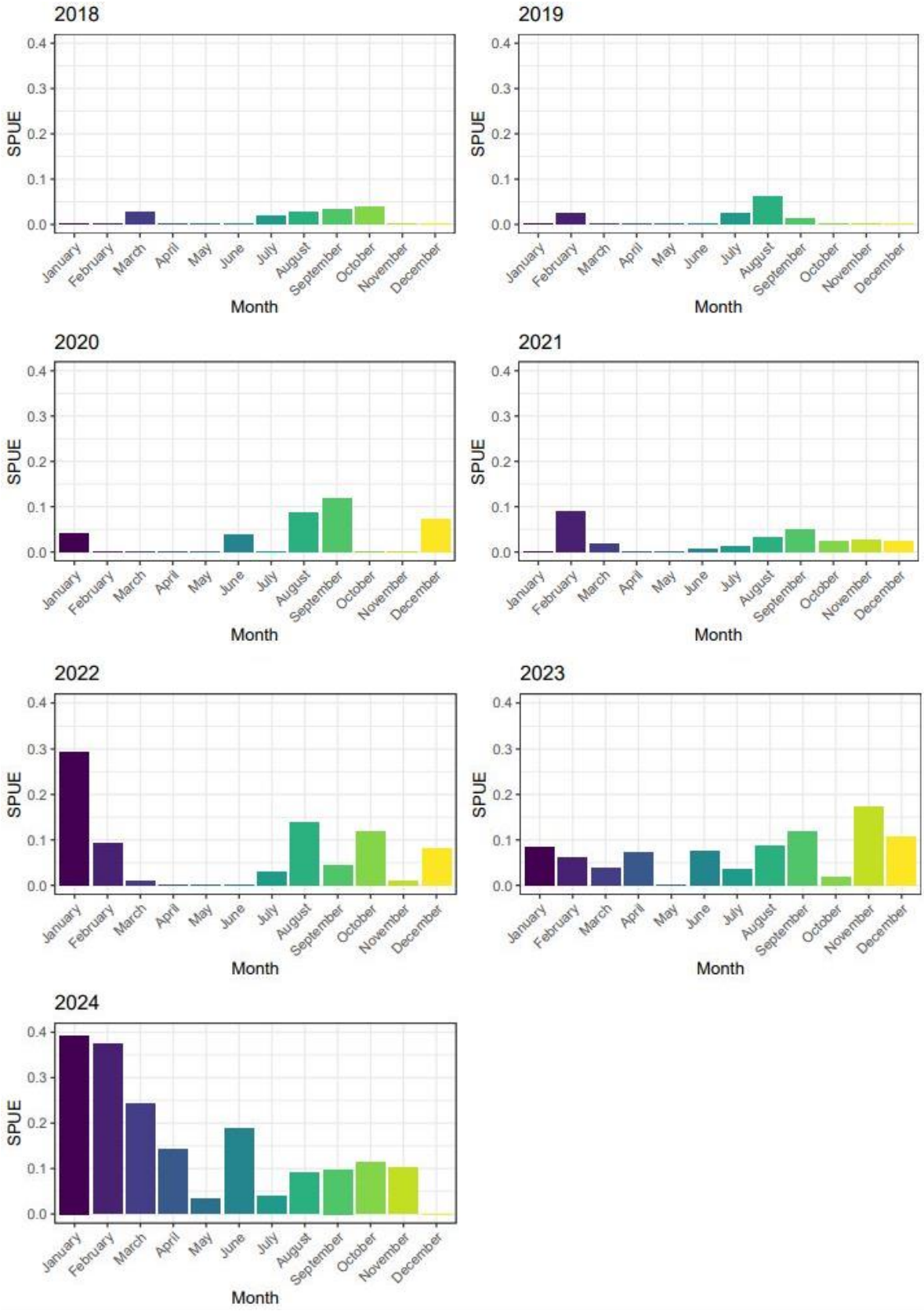

Figure 6: Sightings per unit effort from 2018 to 2024.

Discussion

Although statistical analysis found no significant difference in common dolphin sightings between months, there is a visual trend across the study period which suggests two peaks in abundance – one in late winter and one in late summer/early autumn. This is somewhat reinforced by other research conducted in the Celtic Sea as they found peaks in common dolphin sightings in summer and autumn (Pujol-Soliano, 2018; Baines and Evans, 2012; Paxton et al., 2011). However, there have been no reports of high encounter rates during winter; in fact, Pujol-Soliano (2018) proposed that common dolphins move further south during this season, specifically from December to April. These contrasting results highlight the desperate need for more research into common dolphin abundance and distribution around Pembrokeshire and southwest Wales; this study only recorded common dolphin presence during winter from 2020 onwards which could indicate that population changes have occurred only recently, however since seasonal variation was not proven significant, results and conclusions must be interpretated with caution.

One limitation of current research on common dolphins, and previous studies conducted in the Celtic Sea, is that survey efforts are usually concentrated during summer months – mainly because boat surveys, the most commonly used methodology, are highly restricted by weather conditions (Correia, et al., 2019; Pujol-Soliano, 2018). Therefore, the data collected cannot be truly reflective of common dolphin abundance throughout the entire year. Land-based survey methods, like utilised in this study, are less restricted by weather and can take place in sea states up to Beaufort 5 or 6. This makes them more consistent, however they are limited by visibility and cannot offer a full view of the population in the Celtic Sea, just the individuals which feed or travel close to the coast. To understand the whole population of common dolphins in the Celtic Sea and to address the knowledge gap on seasonal patterns in abundance and distribution, it is vital to collect and analyse year-round data from multiple locations, both offshore and coastal, with estimates of group size (Correia et al., 2021).

Common dolphin sightings in North Pembrokeshire have significantly increased from 2018 to 2024, which suggests two hypotheses: the population of common dolphins in the region is growing or they are experiencing range expansion. The second hypothesis is congruent with predictions of climate change models; Lambert et al. (2011) predicted that common dolphins will benefit from rising temperatures and expand their range northwards, since they are currently limited by water temperature. However, without further analysis using population estimates and environmental factors such as chlorophyll concentration, sea surface temperature and water depth, the reason for the recorded increase in common dolphins in North Pembrokeshire is unknown.

Other studies on common dolphins in the UK have also reported increases in abundance. Gutiérrez-Muñoz et al. (2021) found an increase in common dolphin sightings in Scotland, especially in the north, and Martin et al. (2022) reported that common dolphin strandings have increased in northwest UK waters. Strandings of other warm water limited species, such as striped dolphins, have also increased in northern UK waters whilst those of cold water limited species, such as white-beaked dolphins, have decreased in the same area (Martin et al., 2022; MacLeod et al., 2009; van Weeden et al., 2021). This implies that rises in sea surface temperatures are already affecting multiple cetacean species around the UK, resulting in range shifts and changes in distribution (MacLeod et al., 2009; Lambert et al., 2011; Martin et al., 2022).

There are many implications of climate change and range expansion for common dolphins and the species they interact with and rely on. Although common dolphins may benefit from greater prey availability, other marine mammals may experience out-competition due to the presence of a new predator (MacLeod et al., 2008). In the North Sea and northern parts of Scotland, common dolphins are already outcompeting white-beaked dolphins; they are dominant in waters above 14°C, causing white-beaked dolphins to withdraw into waters less than 13°C (van Weeden et al., 2021; MacLeod et al., 2008). This has serious connotations for white-beaked dolphins as their dietary specialisation, small range size and status as a cooler water limited species make them especially vulnerable to climate change as they have a lower capacity for adaptation and therefore a greater extinction risk (Chen et al., 2022; Silber et al., 2017; MacLeod et al., 2009; Martin et al., 2022).

Despite rising sea temperatures being largely viewed as beneficial for common dolphins, there are certain regions, such as the Alboran Sea and Gulf of Vera, where the habitat may become unsuitable for them and subsequently lead to a reduction in their population size and density (Cañadas and Vázquez, 2017). This highlights the need for dynamic and adaptive management approaches, accounting for regional differences and local industries, despite the common dolphin population in the North Atlantic Ocean being regarded as one single management unit (Murphy et al., 2013; Correia et al., 2021).

Climate change affects all marine species and may influence common dolphins differently than their target prey species. In fact, small fishes are more sensitive to environmental changes like increased sea surface temperature because they are ectotherms, meaning their body temperature is regulated by external sources (Martin et al., 2022). This means they will react faster to rising temperatures and move accordingly, most likely northwards or to deeper waters. Although common dolphins are opportunistic feeders and will adjust their

feeding strategy when preferred prey becomes less available, there are still concerns about how changes in prey distribution, especially energy-rich target species, will affect their fitness (Begoña Santos et al., 2013; Brouder et al., 2025). For example, in years when sardine biomass was low along the Iberian coast, common dolphins shifted their foraging focus to offshore habitats and exploited other local prey, demonstrating their ecological plasticity in response to changes in prey abundance (Brouder et al., 2025). Nevertheless, it is essential to further research the predicted movement of prey species and the effects of changes in their abundance have on common dolphin populations so that distribution and movement changes in response to climate change can be modelled more accurately and adequate protection can be put in place (van Weeden et al. 2021; Begoña Santos et al., 2013; Silber et al., 2017). Furthermore, existing fisheries management plans will need to adapt to consider marine predators like common dolphins overlapping with their range as they feed on commercially important fish species (Silber et al., 2017).

Another question raised by results of this study is whether common dolphin seasonality in North Pembrokeshire is changing and whether it will become more or less evident over the next few years. Findings indicate that common dolphin abundance is increasing in the region, however it is currently uncertain how this, combined with warmer temperatures, will affect their distribution and movements. It is probable that common dolphins are becoming more pronounced as year-round residents rather than summer visitors and it is vital that the population in North Pembrokeshire continues to be monitored so any future trends in abundance, distribution and seasonal movements can be identified. Additionally, more research is needed on the biotic and abiotic factors which influence common dolphin distribution such as sea surface temperature, chlorophyll concentrations and prey distribution so they can inform management plans (Silber et al., 2017).

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Section Three: Reflection

Sea Trust Wales

The first six months of my placement year were an amazing experience. At Sea Trust, I had a large variety of duties and responsibilities which cemented my desire to work in cetacean research in the future. I enjoyed working on all projects/areas within Sea Trust however surveys were definitely my favourite, despite some challenging weather conditions! Over my time at Sea Trust, I refined my spotting and identification skills, becoming efficient at seeing and communicating sightings within the survey team. Working on the porpoise ID project allowed me to develop photo processing, analysis and identification skills as well as build on my previous experience of data entry. This hands-on experience has equipped me with practical and analytical skills which will enhance my CV and pave the way for a successful career in marine conservation.

Usually surveys were land-based, however, in September, a small team of staff from Sea Trust went on a boat trip out towards the Celtic Deep. It was an amazing experience and one of the highlights of my placement since we saw several groups of common dolphins bow riding. It would have been nice to have more opportunities to go on boat surveys; however, I understand they are resource, cost and weather-dependent, especially for a small charity.

Since I enjoyed the process of identifying porpoises, I took on a leading role in the project's tasks within the interns during my placement. Although it could be monotonous and time-consuming, I ultimately enjoyed the experience; it was satisfying when I identified individuals as a match with another in the catalogue and I find the ecological inferences which can be made from this data very interesting. As Sea Trust was my first experience with photo ID, learning a new method and its technical skills associated will be an invaluable addition to my CV. Pattern recognition and attention-to-detail are highly transferable skills which will give me an advantage when working in other disciplines within marine and cetacean biology.

As I had limited experience giving talks to large groups of people, giving an aquarium guided tour, talking at a school visit or leading a Marine Biology Club session took me out of my comfort zone. These aspects of the role helped build my confidence in public speaking and enhanced my presentation skills. Having the opportunity to raise awareness, share my passion for the marine environment and inspire young people was extremely rewarding and fulfilling. This experience strengthens my CV by demonstrating ability to engage with diverse audiences, adapt content to suit different age groups and contribute meaningfully to public

education and awareness – which are invaluable skills in marine research, outreach and conservation.

Since Sea Trust have a catch-and-release aquarium, there is a continuous cycle of diverse local species to care for. I gained knowledge about UK marine species by caring for them in the aquarium, conducting daily health checks and feeding. By rock pooling for live food and new species, I become more adept at identifying local wildlife and developed a greater understanding of food webs and species interactions. Learning about behind-the-scenes tasks and responsibilities involved in running aquariums was very interesting and I enjoyed practical tasks such as changing tank water and cleaning filters.

Although I did enjoy aquarium maintenance and animal husbandry, I found myself gravitating towards other tasks (especially porpoise photo ID) during my placement at Sea Trust; this taught me that having a long-term aquarist career is not for me and reaffirmed my passion to pursue a career in cetacean research and conservation. Despite this, the knowledge I accumulated whilst working in the aquarium will guide and support my future work as I have a more in-depth and connected view of marine habitats and ecosystems.

During my last few months at Sea Trust, I worked on one of their new projects Gardd y Môr, which aims to promote biodiversity and connect local people with nature. Working in collaboration with a great team where our individual contributions were celebrated was extremely rewarding and I am grateful to know my work will have a lasting impact at Sea Trust. I am looking forward to keeping in touch with the team and receiving updates on how the garden is blooming and the positive impact it has. Designing aesthetically pleasing and informative signs and posters is another skill which will be advertised on my CV and transferable to other roles as it is a useful science communication tool; I am able to summarise scientific knowledge and other information in a simple and concise way in which the general public can understand and connect with.

Additionally, working with the Sea Trust team helped me gain more confidence, taught me to advocate for myself and enhanced my interpersonal skills. Dealing with different dynamics was challenging at times but I learnt to be more proactive and adaptive in my approach to group work and problem-solving. I feel confident to ask for help or delegate tasks when my workload becomes overwhelming, knowing it is essential for maintaining both productivity and wellbeing.

In conclusion, my six months at Sea Trust were an invaluable experience, solidifying my passion for cetacean research and marine conservation. I developed a wide range of skills,

from survey techniques and species identification to public speaking and team collaboration. While the placement offered some challenges, such as weather conditions and stepping out of my comfort zone, those experiences have only enhanced my personal and professional growth. I am incredibly grateful for the opportunity to work with such a dedicated team and contribute to meaningful projects, and I look forward to continuing to learn and grow in the second half of my placement year.