

Research Report 2015



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Further details of any of the studies detailed in this report can be gained by contacting the authors or the named contacts for individual projects.



South and West Wales
De a Gorllewin Cymru



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Introduction

The Wildlife Trust of South and West Wales and the wider Wildlife Trusts movement have always endeavoured both to support and to encourage research into the natural environment. We also endeavour to base our own operational decisions upon such work, in order that our actions are appropriate and effective, and defensible in light of the latest research available.

This report summarises all research work undertaken in partnership with or hosted by WTSWW, primarily on its nature reserves, during 2015. These studies are delivered by a huge range of individuals varying from university students and academics, to interested individuals, and in some cases, contracted companies. The report does not cover routine monitoring, but instead summarises original survey or research work that captures new information. Some of these studies are directly relevant to the management of our own estate and are site-specific. Others address hypotheses relevant to the wider movement and include a number of university studies generating original research that is published and of global significance.

In all cases we are indebted to the many partners and funders for their contribution of time, skills and financial support.

ShoreFin Project, Cardigan Bay Marine Wildlife Centre (CBMWC)

County: Ceredigion

Researcher: Sarah Perry, Anna Stevens, Manon Chautard & CBMWC team

Partner organisation:

WTSWW contact: Sarah Perry

Summary

The 2015 field season provided us with our second year of the ShoreFin Project.

Over the last two years the ShoreFin project has identified a total of ninety-two different dolphins that have used New Quay Bay. In 2015, sixty-one individuals were identified from photographs taken by the ShoreFin project, nineteen of which were new to the CBMWC Cardigan Bay bottlenose dolphin photo-identification catalogue. Almost 46% of the individual dolphins visiting New Quay bay in 2015 were also photographed in New Quay bay in 2014.

In 2015 a total of 1788 hours of Dolphin Watch surveys were undertaken where there was the potential for a ShoreFin photo-ID encounter to occur. Thus our survey effort increased during the 2015 season with a total of 199 hours and 15 minutes (119 hour 35 minutes in 2014) spent photographing dolphins in New Quay bay. This comprised of 278 ShoreFin encounters (261 in 2014). The greatest number of encounters occurred in June (87) with the fewest number of encounters occurring in April (28) (Figure 1).

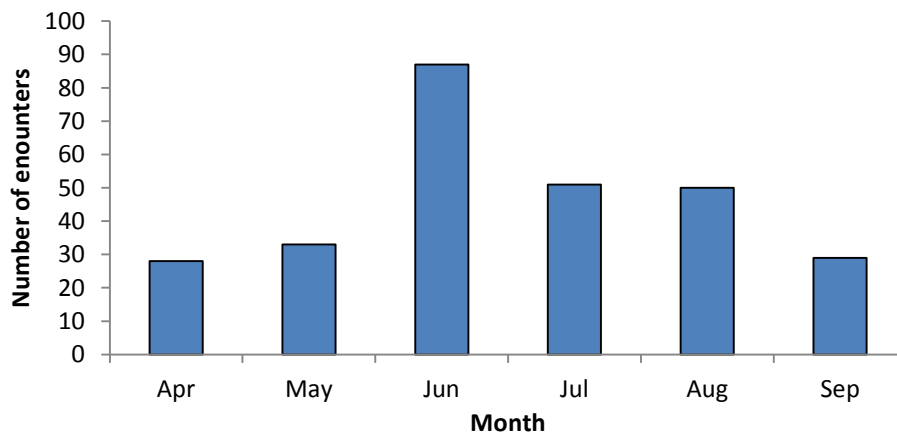


Figure 1: The number of ShoreFin encounters from April to September 2015

The ShoreFin project was able to collect data over 178 days during the 2015 field season. Over those 178 days, encounters occurred on 136 days, resulting in dolphin presence in New Quay bay on 76.40% of survey days. During encounters in 2015, a total of 510 groups of bottlenose dolphins were observed, accounting for 49.70% of the groups observed through Dolphin Watch surveys (see section on CBMWC Dolphin Watch). Of the 278 encounters, 45 did not contain photographs of sufficient quality for identification, resulting in 233 encounters where at least one individual could be identified; an 83.81% success rate.

An average of 27 individual dolphins were identified each month and re-encounters of individuals averaged 10.85 times with a maximum of 87 encounters for one individual (Jacky, number 376) during the season. Four individuals were photographed every month throughout the field season (Figure 3).

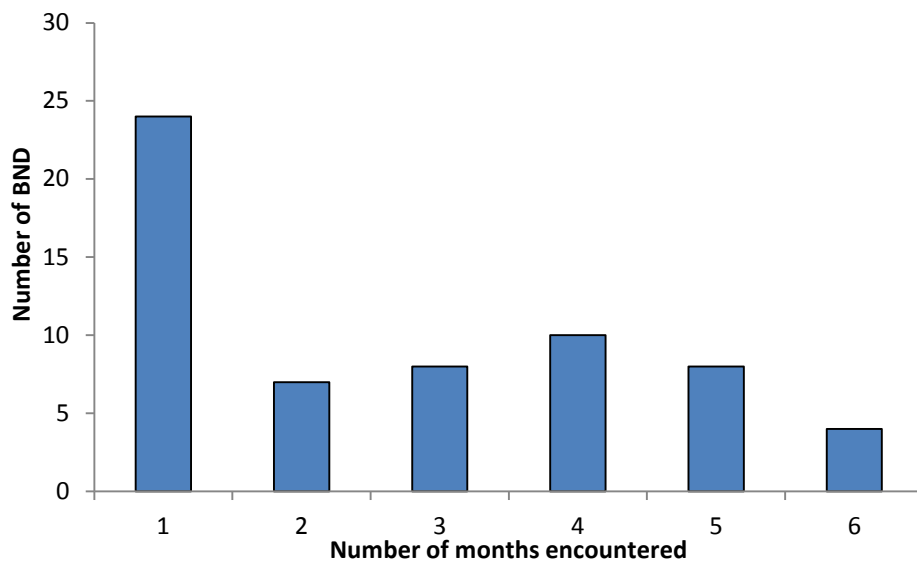


Figure 3: The number of months in which individual bottlenose dolphin were identified

Results from the ShoreFin project also indicate that New Quay bay is a favoured area for mothers and their young (Figure 5). Between April and September ten mother and calf pairings were photographed, this included four mothers with newborns.



Figure 5: Left and right profiles of Jacky (376) and calf (657) one of the mother and calf pairings regularly seen in New Quay bay

The study showed that dolphins displayed behaviours such as foraging, travelling, tail slaps and milling significantly more often than all other behaviours. Both solitary feeding and co-operative feeding in groups by trapping prey were observed and photographed by the ShoreFin project, showing varied methods of foraging occur in the bay.

Observing dolphins feeding enabled the ShoreFin project to photograph and identify bottlenose dolphin prey species in New Quay bay. The three primary species were identified as salmon, mullet and mackerel. Other species dolphins were also observed feeding on included sandeels, bass and either garfish or pipefish (identification not conclusive).

On some of the fish, scale loss patterns could be seen from cetacean predation (Figure 4), likely from tooth rakes. Similarly occurring scale loss patterns have been observed in fish species off the south Wales coast, although causation has not been determined (NRW).



Figure 4: Dolphin catching a possible salmon or mullet (species not confirmed) with scale loss pattern from tooth rakes.

The project has also found that individual bottlenose dolphins show different degrees of site fidelity (the tendency of a dolphin to stay in or regularly return to a particular area): those who were photographed regularly, likely to be semi-residents, and those seen only once during the season, therefore likely to be in transit.

Once again members of the public, both local and visitors showed great interest in the presence of CBMWC ShoreFin researchers photographing dolphins on the harbour wall, as they did in 2014. They were interested in engaging with the ShoreFin officers, in understanding what they were doing and were keen to learn about photo-ID and the project. The ShoreFin project has helped to raise awareness of CBMWC through their presence on the wall as well as through the use of social media with Twitter updates including sightings of regular individuals, newborns and interesting behaviour displays.

The full ShoreFin Project report is [available from the WTSWW website](#) or follow @ShoreFin

New Quay dolphin watch, CBMWC

County: Ceredigion

Researcher: Sarah Perry & CBMWC team

Partner organisation: Ceredigion County Council

WTSWW contact: Sarah Perry

Summary

During the 2015 field season (March to November) Living Seas volunteers at the Cardigan Bay Marine Wildlife Centre conducted 994 land-based surveys from New Quay harbour wall, contributing a vast amount of data to Ceredigion County Council's Dolphin Watch Project. The Dolphin Watch project has been running since 1994 and has completed 22 years of data collection. It is a hugely successful citizen science project providing members of the local community as well as our volunteers with the opportunity to learn new survey techniques as well as collect valuable data on the marine mammals sighted in inshore waters in Ceredigion. These surveys began in earnest on the 28th March 2015 and have

continued throughout the winter months. This is the first year that we have been able to extend our field season and continue collecting data on a regular basis over the winter months; this is thanks to our network of dedicated local volunteers.

In comparison to previous years between 28th March and 31st October our Living Seas volunteers conducted 983 surveys from New Quay harbour wall. This equated to a total of 1966 hours of surveys and 2644 volunteer hours. At least one survey took place every day throughout this period with bottlenose dolphins being recorded on 186 out of 218 days (85.3%).

		Number of survey days	Total number of surveys	Number of survey hours	Number of volunteer hours	Number of survey days when BND recorded	% survey days when BND recorded
2015 (March to end Oct)	218	983	1966	2644	186	85.3%	
2015 (March to end Dec)	237	1006	2012	2696	200	84.4%	



An additional 23 surveys took place over 19 days in 2015 (Table 1) during our extended field season, this has equated to 46 extra Dolphin Watch surveys and 52 hours of volunteer time. So far in 2016 an extra 19 surveys over 14 days have taken place.

Throughout the 2015 field season volunteers at CBMWC conducted some initial analysis on the data collected by CBMWC volunteers throughout the season. A summary report is available to download from the [CBMWC website](#).

The data collected from these surveys contribute to various research outcomes and publications including a bi-annual research report produced by Ceredigion County Council.

This report focuses on the data collected from March to September and includes data from other sites along the Ceredigion coastline. A report detailing [the 2010-2012 survey data](#) shows that compliance with local codes of conduct gave more positive responses (heading towards boats) by bottlenose dolphins and fewer negative response (heading away) and that compliance with the code of conduct was highest in the New Quay area despite this area having the highest levels of boat traffic. The data collected by volunteers from 2013 – 2015 is currently being analysed as part of the Dolphin Watch project and will be published later on in 2016.

Boat-based survey work, CBMWC

County: Ceredigion

Researcher: Sarah Perry & CBMWC team

Partner organisation: Dolphin Survey Boat Trips

WTSWW contact: Sarah Perry

Summary



Our long-term collaboration with local eco-tourism operator Dolphin Survey Boat Trips continued during the 2015 field season which enabled us to conduct 193 vessel based surveys out into Cardigan Bay during the 2015 field season. Our volunteer researchers spent 483 hours collecting data during vessel surveys and recorded a total of 1045 dolphins, 932 Atlantic grey seals, and 96 harbour porpoises. The longer surveys (4 hour and all day surveys) enabled us to continue collecting data for our Cardigan Bay bottlenose dolphin photo-identification project, with a total of 82 vessel based photo-identification encounters with bottlenose dolphins recorded (data collected under licence, issued by Natural Resources Wales). Data collected through these vessel based surveys have been used in

various publications, including the Atlas of Marine Mammals of Wales 2012, JNCC's Joint Cetacean Protocol and more recently data collected by CBMWC has been used to determine potential Special Areas of Conservation (SACs) for harbour porpoises, a consultation which was launched by Natural Resources Wales (NRW) on behalf of Welsh Government in early 2016. Regular data collection is essential in order to monitor the status of our marine life and to ensure the sites are fit for purpose. Funding to support this data collection as well as awareness raising is vital in order for us and others to be able to continue this valuable work.

Dolphin acoustics, CBMWC

County: Ceredigion

Researcher: Sarah Perry & CBMWC team

Partner organisations: Dolphin Survey Boat Trips, St Andrews University, University of Western Australia

WTSWW contact: Sarah Perry

Summary

For a number of years, researchers at CBMWC have been collecting dolphin acoustics data during survey trips in collaboration with Dolphin Survey Boat Trips and researchers from St Andrews University and more recently with researchers from the University of Western Australia. This data collection continued throughout the 2015 field season.

In 2011 CBMWC initiated a research project with St Andrews University. This project formed the basis of an undergraduate dissertation entitled "Identification of Signature whistle types in the bottlenose dolphin population in Cardigan Bay" by Helen Hiley. This research has been further extended and a paper entitled "What's Occurring? Ultrasonic signature whistle use in Welsh bottlenose dolphins (*Tursiops truncatus*)" by Hiley, Perry, Hartley & King was submitted for publication in the journal Bioacoustics in January 2016.

SeaSeals project (Atlantic grey seal photo-identification), CBWMC

County: Ceredigion

Researcher: Sarah Perry, Polly Willis & CBWMC team

Partner organisation:

WTSWW contact: Sarah Perry

Summary

The aim of this project is to create a seal photo-ID database of the Cardigan Bay Atlantic grey seal population in order to monitor their movements, breeding and estimate population size, and to contribute to the wider Irish Seal Survey database.

For a number of years researchers at CBWMC have been collecting photographs of the Atlantic grey seals in the wider Cardigan Bay area and have been in discussion with members of Cornwall Seal Group.

In 2014, the CBWMC launched its Atlantic grey seal photo-identification project; existing photographs were collated in order to begin to develop a photo-identification catalogue for the Cardigan Bay area. The project involves taking and analysing photos of Atlantic grey seals in the Cardigan Bay area in order to identify and recognise individual animals in a non-invasive way. Individuals are identified through the spot markings on the pelage, which are unique to each individual, much like our fingerprints. Photos are taken both from land and boat platforms and are sorted for processing using the computer software ExtractCompare. The software isolates a particular pattern on the pelage and compares this pattern with all the other images on the database, and any possible matches are checked and manually confirmed

The seal photo-ID project therefore aims to create a catalogue of individuals photographed in Cardigan Bay area in order to learn more about their travelling habits and areas that are important to them, collaborating with other organisations working in the Irish Sea in order to learn more about their wider movements and areas of importance to this species.

The data from Cardigan Bay will feed into a larger database covering parts of the Irish Sea that is held by Natural Resources Wales. The database currently holds data dating back to 1992 and encompasses parts of north and south Wales, parts of Ireland and Cornwall, with a data gap covering large parts of Cardigan Bay. There are over 10,000 photos in the database and 3000 individuals have been identified. It is the 2nd largest seal ID database in the world, second to the Sea Mammal Research Units (SMRU) database in Scotland. It is referred to as Eire-phot, Cymru-phot or the Welsh Marine mammal database. There are currently several organisations contributing to the database.

In addition to increasing our understanding of the movements of Cardigan Bay seals, the photo ID project will allow us to analyse behavioural and physiological aspects of both the individual and of the population as a whole. In addition to learning more about our population for our own interest, improving our knowledge on Atlantic grey seals can also be useful for informing conservation managers and policy makers about the most effective methods for Atlantic grey seal conservation.

Atlantic grey seal breeding sites census, CBWMC

County: Ceredigion

Researcher: Sarah Perry, Steve Hartley, Polly Willis & CBMWC team
Partner organisation: Dolphin Survey Boat Trips
WTSWW contact: Sarah Perry

Summary



The 2015 seal pupping season started around the 7th September when the first seal pup was spotted at Carreg Draenog, just south of New Quay headland. Throughout the following six weeks seal pups were sighted and recorded 53 times (this includes multiple sightings of the same pups and multiple pups in one sighting). Pups were sighted from regular boat surveys conducted by our volunteers aboard Dolphin Survey Boat Trips (DSBT) vessels Sulaire and Anna Lloyd. In addition to these opportunistic surveys three dedicated seal surveys were conducted in collaboration with Dolphin Survey Boat Trips. The surveys were conducted aboard DSBT's rib Orca, a 6m Humber rib (rigid inflatable boat).

Surveys took place on the 28th September (New Quay to Ynys Lochtyn), 2nd October (Llanon to Abersystwyth) and 4th October (Ynys Lochtyn to Cemaes Head). Using the small rib enabled us to access areas that were previously inaccessible such as caves and secluded beaches without the physical constraints of the larger passenger carrying boats (Sulaire and Anna Lloyd) or time constraints of a passenger wildlife trip.

A total of 16 seal pupping sites were identified between Aberystwyth and Cemaes Head (Figure 1), these included secluded beaches, public-access beaches, caves and ledges. Some sites were used multiple times through the season with pups either overlapping their feeding period at the same location or being separated by up to a week. Fourteen of these sites were located between New Quay and Cemaes head where the majority of CBMWC's boat surveys take place. Two sites were located north of New Quay however; it was not possible for us to survey the entire coast line between New Quay and Aberystwyth.

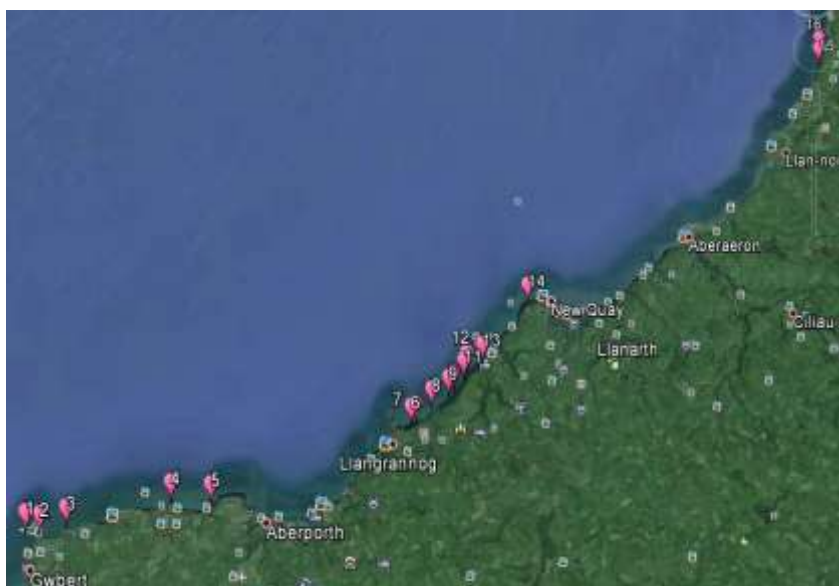


Figure 1: Map to show locations of the 16 seal pupping sites identified between Cardigan Island and Aberystwyth

The most frequently used pupping area appeared to be between Cwm Tydu and Ynys Lochtyn which included 8 of the 16 sites and 13 of the 23 known seal pups. The most popular pupping location was a secluded beach near Castell Bach (location 9) with at least five pups being fed and weaned from this beach, likely more. Five pups were seen at one time on the beach however, the beach was used over the course of several weeks suggesting a greater number were born and raised on this beach.

Social interactions of bottlenose dolphins which behaved aggressively towards harbour porpoises in the Cardigan Bay SAC in 2014

County: Ceredigion

Researcher: Rebecca Bakker

Partner organisation: Van Hall Larenstein, University of Applied Sciences Leeuwarden, Netherlands

WTSWW contact: Sarah Perry

Summary

Rebecca used historical photo-identification data collected by researcher at CBMWC to investigate the interaction between bottlenose dolphins and harbour porpoises observed in the 2014 field season.

The Cardigan Bay Special Area of Conservation (SAC) is inhabited by a semi-resident population of bottlenose dolphins (*Tursiops truncatus*). In the summer of 2014 four attacks of bottlenose dolphins on harbour porpoises (*Phocoena phocoena*) were recorded and witnessed by staff and volunteers from the Cardigan Bay Marine Wildlife Centre (CBMWC).

During the study period from 2010 to 2014 land and vessel based surveys were carried out, during which photographs were taken for photo identification, as well as additional data collected including group size. During the four surveys in 2014 when the attacks were recorded, a total of 26 individuals were observed, of which ten were identified as dolphins already existing in the Cardigan Bay Marine Wildlife Centre catalogue.

Social network analysis was applied to three of the individuals with well-marked dorsal fins which were involved in these attacks, #007, #015 and #036; to investigate the social interactions these individuals have with each other, and other members of the population.

The culprits:



CBMWC #007



CBMWC #015



CBMWC #036

Data analysis showed that the three individuals (the culprits) did not occur in outstanding group sizes, with a mean group size of 5.61 (SD=5.31) for all three individuals. The association between the three individuals is regarded as being casual (HWI's: #007 - #015= 0.24, #007 - #036= 0.20, #015 - #036= 0.29). However, comparing these associations to associations between the three individuals and other members of the populations, the associations among the three individuals are relatively strong. It cannot be proven that the behaviour of attacking harbour porpoises is transmitted horizontally throughout the population however; the relatively strong association among the three individuals does support this theory.

Investigating the potential impacts of vessel activity on bottlenose dolphin behaviour

County: Ceredigion

Researcher: Emma Lowe

Partner organisation: Plymouth University

WTSWW contact: Sarah Perry

Summary

This study focused on the behaviour of bottlenose dolphins; investigating possible relationships between dolphin behaviour and vessel activity in New Quay Bay. The study investigated whether there was a link between dolphin presence and absence when boats are in the area, if dolphins respond differently to different boats and if they behave differently when boats are and aren't present in the bay.

The study aimed to assess whether the Special Area of Conservation (SAC) status of Cardigan Bay and the local codes of conduct are effectively protecting these dolphins, or if heavy boat traffic may be causing negative impacts on their wellbeing.

Initial results of the study showed that the dolphins spent significantly more time exhibiting staying behaviours, and carrying out long dives, often disappearing and not resurfacing in the area, when boats were present in the area than not. They also carried out significantly more active and splashy behaviour such as fast circling, leaping, lunging and mingling at the surface when boats were absent compared to when boats were present. This highlights a clear difference in the way the dolphins act when sharing the area with boats; they also appeared to spend a particularly great amount of time again staying under the water for long periods of time or disappearing, when within 300m of Visitor Passenger Vessels, or general motorboats more than with other boat types.

However, generally when any boats were within 300m of a group of dolphins, the behaviour exhibited most often was staying under water for longer periods of time. This suggests that the presence of boats may be disturbing these charismatic animals causing them to remain below the surface of the water for extended periods when vessels are present.

There are potential long term implications, if boat traffic increases with developing tourism in New Quay harbour, it could lead to long-term site avoidance, and create issues for young and newborn dolphins that are not capable of staying underwater for lengthy periods in order to avoid detection and thus the potential stress placed upon them by anthropogenic disturbance.

An investigation into the effects of boat proximity on the behaviour of bottlenose dolphins (*Tursiops truncatus*) in Cardigan Bay.

County: Ceredigion

Researcher: Sinead Martin

Partner organisation: University of Derby

WTSWW contact: Sarah Perry

Summary

Shore based observation data collected by CBMWC volunteers were used to investigate the effects of boat proximity on the behaviour of bottlenose dolphins in Cardigan Bay.

To minimise potential impacts of boat traffic on the behaviour of cetaceans it is important to assess short-term behavioural responses to boats and interpret the long-term consequences of these. The aim of the study was to identify if there is any effect on the behaviour of bottlenose dolphins dependent on boat proximity and number of boats present.

An enduring challenge in marine conservation science is understanding the impacts of human activities on marine mammals. For species with populations in cosmopolitan coastal areas, such as the bottlenose dolphin *Tursiops truncatus*, contact with humans can be common but potentially detrimental to the health and survival of the dolphins. One of the most frequent anthropogenic threats to dolphins can occur through interactions with marine vessels, and many studies conducted throughout the world have demonstrated that dolphin populations are negatively affected by boat. This research assessed vessel encounters with

bottlenose dolphins. A standard boat encounter was defined as any instance when one or more boats are within 300 m of a group of dolphins during a fifteen minute interval. The preliminary results showed that the motorboat vessel type has the greatest amount of negative reactions whilst the speedboat vessel type has the most positive. This study also uncovered a highly significant result in relation to vessel behaviour. The amount of negative reactions dolphins have towards vessels increases from 4.8% to 31.8% when vessel behaviour is negative. The results indicate that the Cardigan Bay vessel code of conduct is an essential asset to the protection and conservation of bottlenose dolphins.

Unusual sightings in Cardigan Bay (2005-2015)

County: Ceredigion

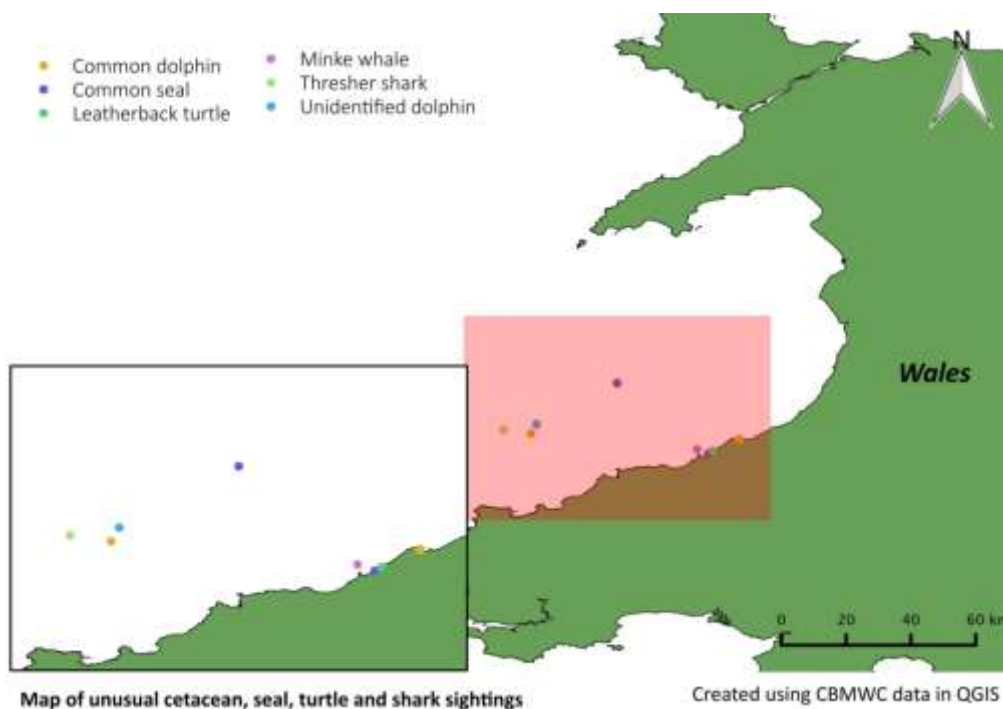
Researchers: Sarah Perry, Laura Palmer, Laura Bampton & CBMWC team

Partner Organisation: Dolphin Survey Boat Trips

WTSWW contact: Sarah Perry

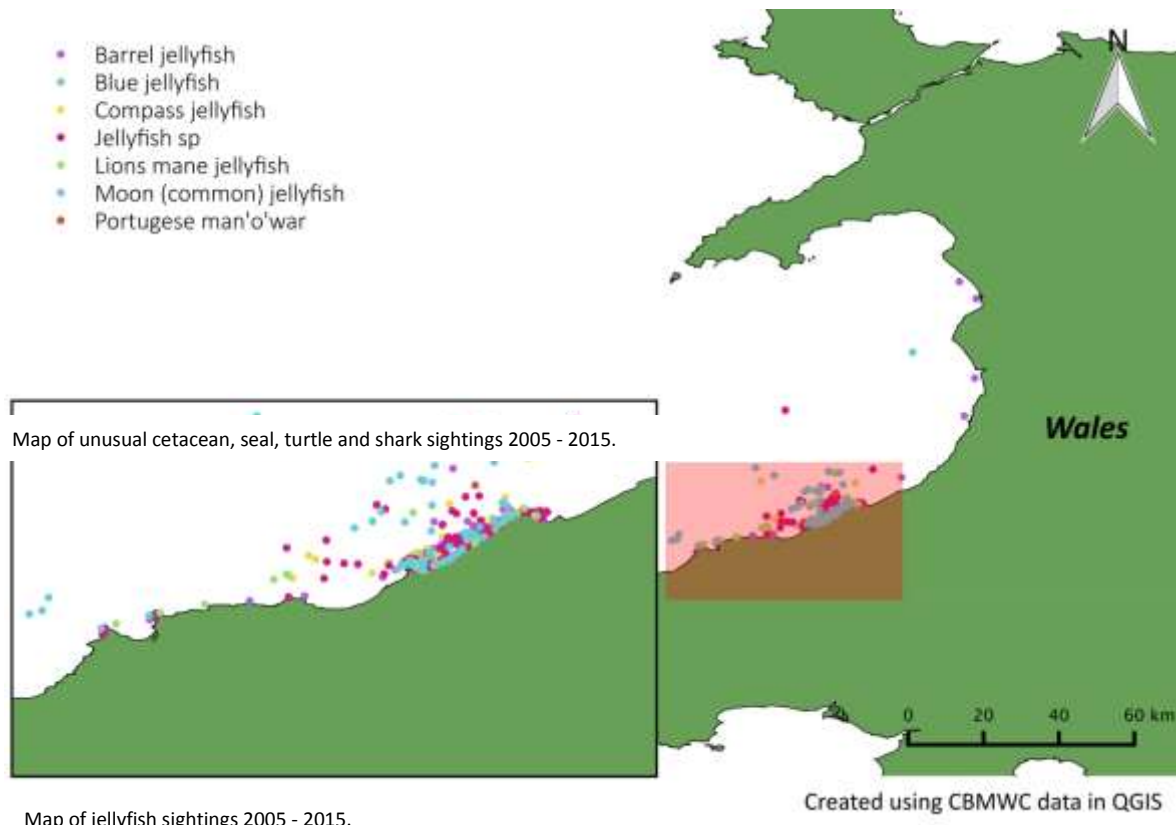
Summary

Researchers from the Cardigan Bay Marine Wildlife Centre (CBMWC) have been carrying out scientific surveys of the marine wildlife in Cardigan Bay for over two decades. Previous analysis has focused on the bottlenose dolphin (*Tursiops truncatus*), Atlantic grey seal (*Halichoerus grypus*) and the harbour porpoise (*Phocoena phocoena*); however a decade of boat-based surveys conducted by volunteers at CBMWC in collaboration with Dolphin Survey Boat Trips provides an opportunity to explore the marine wildlife beyond the Cardigan Bay 'Big Three'. As parts of the bay are designated as a Special Area of Conservation (SAC), it may be valuable to identify other marine wildlife that may be benefitting from the protection of the Bay. This analysis looked at the sightings, recorded during boat surveys, deemed as unusual in the area between 2005-2015; it includes unusual marine birds, jellyfish species or frequencies of jellyfish, sunfish and other marine mammals or large vertebrates.



The map shows the locations of cetacean species other than bottlenose dolphins or harbour porpoises that have been observed during this period. Species include common dolphin and minke whale. The common dolphin sightings constituted of a pod of over 100 individuals offshore in August 2012 and then recurrent sightings of the same individual in New Quay harbour in April 2015. This common dolphin was sighted in New Quay bay every day from the end of December 2014 until the 15th April 2015. A minke whale was spotted in June 2006 relatively close to shore and a thresher shark was sighted in August 2012.

Cardigan Bay also frequently plays host to many species of jellyfish, an important prey species for many larger predators such as turtles and sunfish.



There were high densities of jellyfish sightings in the area throughout the period. There is also a large diversity of jellyfish species present. Sightings, although made ad hoc throughout the period, were most frequent in 2013 and throughout the decade of data there has been several recordings of jellyfish blooms of over 100 individuals. In June 2006 a swarm of thousands of moon (common) jellyfish was seen. Sightings include regular occurrences of *Rhizostoma* sp. (barrel jellyfish).

A full version of this report is available to download from the [CBMWC website](#).

Future Fisheries, CBMWC

County: Ceredigion

Researcher: Sarah Perry

Partner organisation: Welsh Government

WTSWW contact: Sarah Perry

Summary

Our Future Fisheries Project enabled us to gain a much better understanding of the local fishing industry. The project aimed to champion a low impact, profitable fishing industry in Wales whilst securing Living Seas where marine wildlife thrives. Part of the project aim was to add value to the information held by statutory bodies by combining information available on the fishing industry into one place that was easily accessible to the public; for this purpose we produced two Future Fisheries reports: Living Seas: Future Fisheries, The Welsh Fishing Industry and Living Seas: Future Fisheries, Assessment of Welsh Fisheries. These reports are available to [download from our website](#).

In addition to these reports we produced information in a range of formats to promote our low impact local fisheries as well as provide information to the wider public, this information is displayed in our visitor centre alongside our Cardigan Bay Sea Quest.



Cardigan Bay Sea Quest forms an important part of our Future Fisheries project, helping to raise awareness of the marine environment and fostering an understanding of the local fishing industry in an entirely new way that inspires the whole family. It is the most innovative part of the project, being the first 3D virtual reality game of its kind in Wales.



We worked with local establishments and Living Seas champions to produce our “Wild Welsh Fish Dish Recipe book” to showcase a range of dishes using seafood caught locally in Welsh waters using low impact methods. The book includes fish stock recipes, tips on simple ways to cook fish and humane preparation of lobster and crabs, as well as information about restaurants and places to source local seafood in south and west Wales.

Part of the Future Fisheries project aim was to foster a closer working relationship with Welsh Government and industry representatives. The project provided us with the means to liaise with representatives from Welsh Government departments, representatives of the fishing industry including the Welsh Fishermen’s

Association, academics who have been involved in fisheries management and research in Wales, 23 fishmongers, 8 seafood merchants and 58 local restaurants/ cafes, other relevant organisations and representatives from local councils and members of the public with an interest in fisheries in Wales. This liaison, in particular with members of the public and other organisations highlighted how little information is known about the industry.

As part of the Future Fisheries project we were interested in the Deck to Dinner plate scenario, in order to find out about the origin and destination of fish caught in Wales. As part of a small pilot study we interviewed the local fishers, fish mongers, seafood merchants and local restaurants that we had contacted, to build up a picture and greater understanding of the Deck to Dinner plate in Wales. Fishmongers recognised that there is an increasing demand for local seafood, with customers wanting to know which seafood is caught locally, in addition to what is farmed or wild-caught. Restaurants stated that they would prefer to buy from local fishers but that it is difficult to buy directly from them, competitive prices are a barrier to buying from local fishers as well as supply.

Phase I Eco-hydrological Survey, Ffrwd Farm Mire

County: Carmarthenshire

Researcher: Rob Low, Rigare Groundwater & Wetland Science

Partner organisation: Carmarthenshire County Council, Natural Resources Wales

WTSWW contact: Rebecca Killa

Summary

WTSWW manage the majority of the Gwernydd Penbre SSSI, and specifically the large, central triangular-shaped area comprising Ffrwd Farm Mire nature reserve. The commissioned report documents the findings of a scoping level (sometimes called *Phase 1*) eco-hydrological survey, commissioned by WTSWW from Rigare Ltd, with a view to informing future conservation management of the site.

The eco-hydrological functioning of the site is complex, and a working hypothesis was presented, based on interpretation of the limited available evidence. Where the Pennant sandstones crop out as Mynydd Penbre, immediately to the south of the site, a significant proportion (c. 45%) of incident rainfall infiltrates the ground surface to become groundwater. Groundwater flow in the Pennant sandstones is mainly through the fracture network, and the groundwater catchment to the site is likely to be more-or-less coincident with the surface water catchment.

Till overlies the Pennant sandstone beneath the site and extends southwards to the break of slope on Mynydd Penbre. The till is clay-rich and forms a poorly permeable cover to the Pennant sandstone. Groundwater pressure in the Pennant sandstones beneath the site is strongly artesian, i.e. if a borehole is drilled into it the groundwater will rise to the surface and overflow, as demonstrated by the overflowing artesian borehole found during this project. This means that there is an upwards hydraulic gradient from the Pennant sandstones to the shallow estuarine and blown sand deposits within the site. The amount of upwards groundwater flow which occurs in response to this gradient depends primarily on the hydraulic conductivity of the till, and is unknown. It is thought likely though that there is at least a continuous eco-hydrologically significant amount of upwards groundwater flow and discharge into the site from the Pennant sandstone.

This upwards groundwater flow from the Pennant sandstone probably discharges widely across the site, but its wetting effect is only apparent along the southern boundary of the site, upslope of the large zone of inundation to the north, where it creates soligenous conditions (i.e. a seepage slope) in some areas.

The dominance of S4 swamp and the observed conditions during the two field visits suggest that the site is inundated (i.e. topogenous conditions prevail) for large parts of the year. This inundation is caused by a combination of the flatness of the site, the low banks around the low-lying parts of the site (i.e. topographic barriers to flow), and the relative ineffectiveness of the drainage network. It is thought likely that the lack of maintenance of the drainage network, within and perhaps downstream of the site, has caused the southern limit of topogenous conditions to move south, and the period of inundation to increase. This has been at the expense of the area of soligenous conditions around the southern margin of the site; this is consistent with the suggested displacement of M23a swampy variant with S10b community in the central eastern part of the site.

It was not possible to identify the location or locations of discharge from the site during the current project, through a combination of limited field time and extremely difficult access because of dense scrub. No evidence of discharge in the vicinities of the discharge points marked on 1-10,000 scale mapping could be found.

The presence of enriched vegetation where the main inflow enters the low-lying area of the site suggests strongly that the inflow is the source of enrichment, but the nitrate concentration of a single water quality sample was relatively low.

Manx shearwater studies on Skomer Island

County: Pembrokeshire

Researcher: Natasha Gillies, supervisor Prof. Tim Guilford (undergraduate project)

Organisation: University of Oxford

WTSSW contact: Ed Stubbings, Bee Büche

Summary

Manx shearwaters (*Puffinus puffinus*) exhibit a biparental incubation strategy in which each parent takes turns to undertake a long (on average 6 days) incubation stint. During this time the sitting bird will lose a significant proportion of its mass, which is then recouped on the foraging excursion at sea that follows its stint. These shifts are highly coordinated, but the mechanisms by which this is maintained are not understood. This study aimed to elucidate the factors leading to this synchrony in incubation behaviour.

The changes in body condition of 18 pairs of Manx shearwater parents breeding on Skomer Island were monitored for the entire incubation period (May – July 2015) by maintaining a log of the mass of the incubating parent and dividing this by its tarsus length. Additionally, foraging activity was tracked using salt-water immersion loggers. Through this, it was revealed that the body condition at which birds begin their foraging excursion is the best predictor of the length of time they will subsequently spend at sea. It was found that birds at sea did not increase their foraging activity relative to the amount of condition they needed to recoup, and instead would extend the length of their excursion proportionally. As a result, the

length of the incubation stint of the sitting bird appears to be constrained by the length of time its foraging partner needs to spend at sea in order to restore its body condition.

Puffinosis incidence distribution on Skomer Island

County: Pembrokeshire

Researcher: Dr Matt Wood

Organisation: University of Gloucestershire

WTSSWW contact: Ed Stubbings, Bee Büche

Summary

Understanding the environmental drivers of infection can inform study of the ecology and epidemiology of diseases in wild populations. Puffinosis is a disease that affects thousands of juvenile Manx shearwaters on the islands of Skomer and Skokholm each year, which is usually fatal. Although this substantial mortality does not limit the growing population, the species breeds on a limited number of island sites and is vulnerable to change. Previous work in the 1980s identified marked predictability in the spatial distribution of the disease, being associated primarily with wet areas. A survey was conducted of the incidence of puffinosis on Skomer over five years and a Geographical Information Systems approach used to scrutinise potential predictors of the incidence of puffinosis, including local environmental features such as proximity to water and distance to the coast, and whole-island survey data on breeding burrow density. Puffinosis on Skomer was found to be most prevalent close to water bodies, and away from the coast, confirming the association with wet areas of the island. The disease was less prevalent at higher population densities, perhaps indicating that the disease may be vector-borne and/or associated with poor adult breeding. This work informs current attempts by wildlife disease biologists to reveal the cause of this intriguing disease, which remains elusive.

Does biodiversity affect wildlife disease ecology? Investigating wild rodents diseases in Wales to test the “dilution effect”

County: Pembrokeshire

Researcher: Flavia Occhibove PhD student, supervisor: Dr Claire Risley,

Organisation: IBERS (Institute of Biological, Environmental, and Rural Sciences) - Aberystwyth University

WTSSWW contact: Ed Stubbings, Bee Büche

Summary

Currently, biodiversity is declining at a global scale; however, we rely upon ecosystem services, which are in turn threatened by biodiversity loss.

Is it possible that another ecosystem service is the “dilution effect”? It emerged that more diverse ecosystems “dilute” pathogens prevalence in wildlife populations, also decreasing zoonotic risk. The debate is still open and more studies are needed to understand whether this is a general phenomenon, which are the biodiversity aspects that are involved, and which are the underlying mechanisms.

My research aims to play a part in solving this debate. In particular, I am investigating whether and how host-diversity and/or community-diversity influence pathogens transmission among wild ground-dwelling rodents in Wales.

Rodents have been live-trapped to estimate population densities, and biological samples, droppings and ectoparasites (ticks and fleas), have been collected to assess pathogens presence/prevalence. The sampling has been carried out with a live-trapping grid located in different locations in Wales, including Ceredigion, Pembrokeshire and Skomer Island in spring/summer 2015 (sampling will be repeated in 2016). The pathogenic agents considered comprise the directly transmitted Coronaviruses and vector-borne and zoonotic agents, including *Borrelia burgorferi* (Lyme disease agent). Empirical data will be used to construct and parameterise models of infection, with which I will test the effects of host-species relative densities (species evenness), contact rates and competence in transmitting the disease on the pathogens epidemiology; also, the effect of competitor and predator species will be taken in account.

In conclusion, this study will try to address some of the issues that are still unclear in the context of dilution effect. The information gathered, in the existing context of critical environmental changes, might be valuable to better understand disease ecology in order to promote more effective wildlife management, and environmental policies that support biodiversity conservation and public health.

On Skomer Island the trapping was performed thanks to the cooperation of Dr Tim Healing and WTSWW staff and volunteers on the island. We caught Skomer voles (*Myodes glareolus skomerensis*) and wood mice (*Apodemus sylvaticus*), but the traps were also visited by some shrews (signs of escape through the shrew holes). The density of Skomer voles was very high, as confirmed by the annual monitoring by Dr Healing, while wood mice were only a minor component of the rodent community. Very few ticks and fleas were found on the animals, which were quite highly infested by orange mites, presumably of the Trombiculidae family.

Ramshorn Snails (Planorbidae, *Anisus* sp.) and the non-marine molluscs of Skokholm Island

County: Pembrokeshire

Researcher: Ben Rowson

Organisation: National Museum of Wales

WTSWW contact: Richard Brown, Giselle Eagle

Summary

There is taxonomic debate over whether both the White-lipped Ramshorn *Anisus leucostoma* and the Button Ramshorn *Anisus spirorbis* occur in Britain, and how they can be distinguished. Museum specimens collected by Charles Oldham on Skokholm in 1925 are unusually like the much rarer *A. spirorbis* based on shell measurements.

A survey of Skokholm's freshwater bodies in 2015 obtained adult specimens for dissection from two locally-seeded artificial ponds. Analysis suggests these are conspecific with those from 1925, and that Skokholm shells differ in both size and shape from mainland *A. leucostoma*. However, their anatomy is intermediate between *A. spirorbis* and *A.*

leucostoma. It is suggested that the Skokholm populations are a dwarf form of *A. leucostoma*.

The other non-marine mollusc fauna of Skokholm was surveyed and compared with records from the Observatory's library and national networks. At least 7 freshwater and 21 terrestrial mollusc species have been reported, including 3 apparently newly-recorded from the islands in 2015, including the Nautilus Ramshorn *Gyraulus crista*. Not all freshwater species previously recorded from Skokholm were re-found.

Conditioned taste aversion of artificial lapwing eggs

County: Glamorgan (Parc Slip)

Researcher: Megan Howells and Alexandra Kinsey

Partner organisation: Cardiff University

WTSWW contact: Vaughn Matthews

Summary

Lapwing are ground-nesting birds whose eggs are vulnerable, and easily accessible to predators. Conditioned taste aversion - training a predator to associate a specific food source with an undesirable taste, to deter consumption - could potentially be applied to the conservation of lapwing at Parc Slip. In October we began preliminary experiments with mock lapwing eggs: quail eggs and painted chicken eggs. The aim was to condition lapwing predators on the reserve not to take the mock eggs, by the time of the lapwings arrival in the following months.

The aversive substance used for these experiments was Bitrex™, denatonium benzoate, the bitterest substance available that has a very low toxicity, and is safe to ingest in controlled quantities. The Bitrex™ was injected into the egg contents or applied to the eggshell. These 'treated' eggs were placed in clutches of four and were set alongside untreated eggs, 'control' eggs. If the aversion was successful the predators would learn not to take any mock eggs, whether treated or control.

Camera traps were used to record predation activity of the eggs during the day and the night. We recorded several types of predator taking and eating the eggs, such as: badgers, foxes and magpies. We also recorded the first record of polecat active on the reserve, which despite interest did not eat the eggs.

Our overall results were varied but indicated that mammals were averted by the Bitrex™. Corvids were not deterred by the Bitrex™, and had started to learn that eggs were readily available on the reserve. For this reason we terminated the experiment in December to reduce the risk of increased egg predation in the lapwing nesting season. With further research we believe it may be possible to condition corvids at Parc Slip to avoid eggs, but this would require stronger aversive substances due to their taste perception.

Lapwing monitoring and conservation at Parc Slip

County: Glamorgan

Researcher: Alexandra Kinsey and Megan Howells

Partner organisation: Cardiff University
WTSWW Contact: Vaughn Matthews

Summary

We are continuing previous monitoring of lapwing breeding success in the Lapwing Field and Northern Wetlands at Parc Slip nature reserve (see 2014 report). We aim to increase understanding of this species and develop methods to increase breeding success. We have developed two individual projects which will contribute to our degrees at Cardiff University.

The first project focuses on lapwing behaviour throughout the breeding and nesting season. This requires observation of the lapwing at regular intervals from a portable hide. QGIS software will be used to map the location of individual lapwing within the field, with intention to determine territorial boundaries of mated pairs. When chicks have hatched the behaviour (e.g. defensive behaviour against predators) and territorial boundaries will continue to be assessed to discern if there are changes in these qualities.

In February 2015 an electric fence was installed around the Lapwing Field and Northern Wetlands, to exclude mammalian predators. Avian predation remains a threat to lapwing eggs and chicks within the field. The second project seeks to prevent avian predation of lapwing chicks using artificial shelters, placed in the Lapwing Field. The shelters are simple, wooden A-frame structures, of two different heights, that serve as a refuge for chicks to hide from avian predators. The activity of these shelters will be monitored once chicks have hatched to determine whether they fulfil their purpose. Again QGIS will be used to show preference for high or low shelter and their position within the field.

For both projects we aim to observe nocturnal activity as we are aware most predation occurs during this time.

Foraging behaviour of woodland birds, Coed y Bedw

County: Glamorgan

Researcher: Rosemary Holden

Partner organisation: Cardiff University

WTSWW contact: Vaughn Matthews

Summary

During winter, birds are more likely to search for foods which have a high fat content, so that they have a better chance of surviving in the short term (at night or during colder periods), and in the long term, so that they can reproduce in the Spring. Natural prey, for example invertebrates, are scarcer during winter, hence the search for high-fat content foods is more important.

As food is scarce, competition between individuals maybe more prominent, both within and between species. Therefore, a dominance hierarchy may become established, where more dominant birds will prevent the subordinate birds from feeding on the high fat foods, increasing the chances of survival for the dominant birds.

At Coed y Bedw, four feeding stations were established, each containing a selection of high-fat and low-fat content foods: peanuts, mealworms, sunflower seeds, corn flakes and bran

flakes. The stations were filmed, and the behaviour of the birds were analysed - whether the birds decided to eat the high-fat foods (peanuts, sunflower seeds, or mealworms) or the low-fat foods (bran flakes and corn flakes).

After analysing the videos, most birds ate the foods which were high in fat, with the low-fat content foods mostly ignored. In addition, a dominance hierarchy was established between birds, with Eurasian nuthatches (*Sitta europaea*) being the most dominant, followed by European robins (*Erithacus rubecula*), then by blue tits (*Cyanistes caeruleus*) and great tits (*Parus major*), and the most subordinate birds being coal tits (*Periparus ater*). Nuthatches would attack any bird at the station, preventing the subordinate individuals from feeding, whereas coal tits would fly off if any other species of bird were at the feeding station.

The impact of road traffic noise on small mammal abundance and distribution

County: Glamorgan

Researcher: Joe Mason

Partner organisation: Cardiff University

WTSWW contact: Catherine Lewis

The aims of the research conducted at the Dow Corning field site were to investigate the effects of isolated road traffic noise on the abundance and distribution of the small mammal species present. Data was collected at the site using small mammal traps.

Randomly selected transects had a speaker placed at each of their mid-points, cardboard mock-speakers were placed at the transects without real speakers in order to control for any visual impact caused by the speaker presence. The speakers played a 33 second MP3 sound file of road traffic noise looped continuously.



A total of 365 small mammals captures were made over the course of the fieldwork, approximately half of them were recaptures. Field voles accounted for 64% of the total captures, bank voles 16%, common shrews 13% and wood mice 7%.

A binomial general linear model analysis was used to analyse the results.

The biggest result was that the presence of traffic noise significantly reduced the trappability of bank voles.

An unexpected finding was that there was no significant correlation between the presence of road noise and the number of field voles trapped.

The presence of road noise could have been interpreted by the bank voles as a predation threat, either by being directly mistaken for a predator or increasing the threat of predation by disguising the sounds of potential predators. The presence of road traffic noise could have therefore decreased bank vole activity and increased vigilance, resulting in the lower trappability found. The recapture results from the fur-clipping support this conclusion as they show bank voles did not move away to other areas to avoid the traffic noise and so the lower numbers of animals trapped were not due to individuals leaving the area.

An unexpected finding was that there was no significant correlation between the presence of road noise and the number of field voles trapped. This result was unusual because field voles are very similar to bank voles both behaviourally and morphologically. However, bank voles spend more time foraging out in the open than field voles (which tend to travel more often through burrows and runs) and therefore may have been more sensitive to sudden auditory changes in the environment.

DNA barcoding and metabarcoding of fungal communities of conservation concern

County: Ceredigion, Carmarthenshire, Pembrokeshire

Researcher: Hannah Metcalfe, supervisor Dr Gareth Griffith

Partner organisation: Aberystwyth University (KESS MPhil supported by WTSWW)

WTSWW contact: Lizzie Wilberforce

Summary

DNA barcoding has become a widely used practice in the identification of species as it is a quick and relatively straightforward method which is often more efficient than relying on the identification skills of taxonomists, especially where morphological features are difficult to discern with certainty. Fungi in particular are notoriously difficult to identify in the field and microscopy is necessary to distinguish visually similar species.

Results suggest that there is potential for combining metabarcoding and ecological data to vegetation surveys to explore above and below ground community interactions. The further addition to DNA barcode databases will increase reliability and add to the understanding of community dynamics. This study shows that there is value in metabarcoding in conservation, particularly in efficiency of surveying for conservation value of sites.

The Clavariaceae are starting to be re-organised through the re-evaluation of sequence data in Genbank in work undertaken by Birkebak et al. (2013) and Olariaga et al. (2015). The addition of local sequences, confirmed by a taxonomic expert, has revealed inaccuracies to the current understanding of the placings of some species within the phylogenetic tree, often caused by errors in identification. An example found through this study is the difficulty in distinguishing between *Clavulinopsis laeticolor* and *Clavulinopsis helvola*.

Succisa pratensis, anecdotally thought to be difficult to germinate and establish, has been seen to be present in a range of habitats, from drier species rich grasslands to wet raised bog sites. The fungal communities do not appear to be plant specific with the same set of fungi appearing at each site, rather they have been seen to cluster according to environmental conditions such as organic matter content.

Finally, a survey of the fungi of Skokholm Island used next generation sequencing to identify fungi to genus level within sites previously designated by Parker-Rhodes as being distinct in vegetation type. Using Tablefit, NVS categories for the ground cover at the time of surveying identified 4 vegetation types: *Pteridium*, *Hyacinthoides non-scripta*, *Erodium maritimum* and *Silene uniflora*. There were no significant differences seen between vegetation types relating to their fungal communities.

Post-release monitoring of water vole (*Arvicola amphibius*) populations at Ffrwd Farm Mire SSSI – habitat utilization and predation

County: Carmarthenshire

Researcher: Sammy-Jo Pengelly, supervisor Dr Penny Neyland

Partner organisation: Swansea University (WISE MSc with WTSWW)

WTSWW contact: Lizzie Wilberforce

Summary

Water voles were reintroduced to Ffrwd Farm Mire nature reserve in 2015 and 2015 in partnership with Natural Resources Wales. This project was designed to undertake post-release assessments of the population. The aims were:

1. To determine the current habitat use by water voles in Ffrwd Farm Mire, Pembrey
2. To map out vegetation patches and determine the landscape heterogeneity of Ffrwd Farm using GIS software
3. To determine habitat utilisation by water voles (via field signs/sightings) per vegetation type
4. To determine predation pressure on water voles by collecting predator (e.g. fox, mink, otter, heron) field signs (scats, spraints, pellets) and analysing them for the presence of water vole remains.
5. To contribute toward the Wildlife Trust's management plan for Ffrwd Farm Mire SSSI.

Fieldwork was undertaken during 2015; a full report will hopefully be available soon.

Peer-reviewed publications relating to WTSWW nature reserves or projects in 2015

Dean, B., Kirk, H., Fayet, A., Shoji, A., Freeman, R., Leonard, K., Perrins, C.M., & T. Guilford (2015) [Simultaneous multi-colony tracking of a pelagic seabird reveals cross-colony utilization of a shared foraging area](#). Marine Ecology Progress Series 538: 239–248

Fayet, A., Freeman, R., Shoji, A., Padget, O., Perrins, C.M., & T. Guilford (2015) [Lower foraging efficiency in immatures drives spatial segregation with breeding adults in a long-lived pelagic seabird](#). Animal Behaviour, Volume 110, Pages 79–89

Fayet, A., Freeman, R., Shoji, A., Boyle, D., Kirk, H.L., Dean, B.J., Perrins, C.M., & T. Guilford (2016) [Drivers and fitness consequences of dispersive migration in a pelagic seabird](#). Behavioural Ecology January 2016 pp. 1-12

McCollin, D (2015) The curious case of Skokholm: equilibrium, non-equilibrium and a phase shift in an island landbird assemblage. Ecography Volume 38, Issue 10, pages 986–991

Shoji, A., Aris-Brosou, S., Fayet, A., Padget, O., Perrins, P., and T. Guilford (2015) [Dual foraging and pair-coordination during chick provisioning by Manx shearwaters: empirical evidence supported by a simple model](#). Journal of Experimental Biology

Shoji, A., Aris-Brosou, S., Culina, A., Fayet, A., Kirk, H., Padget, O., Juarez-Martinez, I., Boyle, D., Nakata, T., Perrins, C.M., & T. Guilford (2015) [Breeding phenology and winter activity predict subsequent breeding success in a trans-global migratory seabird](#). Biology Letters, Volume 11, Issue 10

Shoji, A., Elliott, K., Fayet, A., Boyle, D., Perrins, C.M., & T. Guilford (2015) [Foraging behaviour of sympatric razorbills and puffins](#). Marine Ecology Progress Series, Volume 520



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