Swansea University
Prifysgol Abertawe

Role of intertidal seagrass (*Zostera spp.*) habitats in supporting wintering birds in two British estuaries

Emma Butterworth

Swansea University

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Abstract

Estuaries in Britain provide internationally important foraging resources for overwintering avian species. Seagrass, *Zostera spp.*, in these estuaries provide significant benefits for epi- and infaunal invertebrates, yet little is known about the role of seagrass in supporting migratory invertivorous birds. Bird count surveys were conducted in Chichester Harbour (CH) and Milford Haven Waterway (MHW) in February and March respectively, in areas containing seagrass and unvegetated sediment. Densities of feeding birds were compared between seagrass and unvegetated habitats, as well as areas characterised by annual and perennial seagrass populations. Here I show that intertidal seagrass should be regarded as an important foraging resource for overwintering birds, including 18 species listed by the Convention on the Conservation of Migratory Species of Wild Animals (CMS); but that its role varies between species and regions. Evidence shows that coastal and estuarine species with broad dietary niches are largely unaffected by seagrass presence. However, evidence was found that seagrass across both regions mitigated the limiting effects of tidal changes in three species of wader (redshank *Tringa totanus,* oystercatcher *Haematopus ostralegus,* dunlin *Calidris alpina*). It also provided a stable environment which was used by corvids in MHW to exploit intertidal foraging resources, a previously unrecognised behaviour in this area. This study demonstrates that seagrass has a role in migratory avian ecology and provides a foundation for further research of its role as a foraging resource. It is anticipated to underpin the formation of an inventory of migratory avian species that use seagrass ecosystems, as encouraged by the CMS.

Lay Summary

Britain's estuaries are crucial feeding grounds for many bird species that migrate and spend the winter there. Seagrass (*Zostera spp.*), a flowering marine plant that forms underwater meadows along the coast of Britain, supports various small marine invertebrates; yet we know little about how seagrass is used by migratory birds that consume these species. In this study, I observed birds in two British estuaries—Chichester Harbour and Milford Haven Waterway—in areas with and without seagrass. By counting feeding birds in these locations, I could compare how different bird species used seagrass habitats versus bare sediment. Evidence suggest that seagrass is an important food resource for many overwintering birds, including 18 species listed by the Convention on the Conservation of Migratory Species of Wild Animals (CMS) which are involved in international conservation efforts. However, I found that seagrass usage differs depending on the species and location. Birds with varied diets seemed less affected by seagrass presence than species with more limited foraging needs. Notably, three wader species (redshank *Tringa totanus*, oystercatcher *Haematopus ostralegus*, and dunlin *Calidris alpina*) were foraging in more stable numbers across tidal changes in seagrass habitats. Additionally, crows in Milford Haven took advantage of seagrass areas to forage—a behaviour not previously documented there. This study highlights that seagrass does support birds in winter by providing a reliable food source, especially for species with specific foraging needs. These findings pave the way for creating a detailed inventory of migratory birds that use seagrass habitats, which could help guide future conservation efforts.

Redshank on intertidal seagrass. Photo by author.

University Declarations and Statements

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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Acknowledgements

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Abbreviations

AIC - Akaike information criterion

BTO - British Trust for Ornithology

CH - Chichester Harbour

COP14 - Conference of the Parties

CMS - Convention on Migratory Species

GIS - Geographic Information System

GLMM - Generalised Linear Mixed Models

LTC - Low Tide Count

MHW - Milford Haven Waterway

NA - Not Applicable

nMDS - Non-metric Multi-Dimensional Scaling

PAH - Polycyclic Aromatic Hydrocarbon

SAC - Special Areas of Conservation

SD - Standard Deviation

SPA - Special Protection Area

Spp. - Species

SSSI - Site of Special Scientific Interest

SWD - Seagrass Wasting Disease

UK - United Kingdom

WeBS - Wetland Bird Survey

Introduction

Global estuaries support large numbers of waders, wildfowl, and other birds. They comprise one of the planet's most dynamic and biologically productive ecosystems; characterised by abundant vegetation, fluctuating salinity, and nutrient rich waters and sediments (Correll, 1978; Barbier et al., 2011). In the British Isles the moderating effect of the Gulf Stream means that the winter climate is notably milder than that of other regions at similar latitudes (Lydolph, 1989). The considerable biological productivity and moderate climatic conditions enable British estuaries to support overwintering waders and wildfowl in internationally important numbers (Stroud et al., 1990). It is estimated that 12.8 million waterbirds over-winter in the UK annually (Frost et al., 2019).

Within estuarine ecosystems there exists a range of productive habitat types such as saltmarsh, intertidal sediment, and creeks, that are key to supporting this abundant birdlife (Prater, 1981). Floral-dominated habitats are characterised by saltmarsh species or seagrass, and unvegetated sediment is principally dominated by infaunal invertebrates (Hughes et al., 2000; Kinderburg et al., 2022). Saltmarsh typically inhabits the upper reaches of the intertidal zone, whereas seagrasses are adapted for complete immersion and so primarily inhabits the lower reaches along with unvegetated sediments (Boorman, 2003; Hogarth, 2015). Intertidal seagrass and unvegetated infaunal-dominated sediment habitats occur within areas of comparative environmental conditions; each provide similar ecological roles yet comprise distinct floral and faunal communities (Connoly, 1997; McCloskey and Unsworth, 2015; Kinderburg et al., 2022). Although the value of estuaries in supporting birdlife is well recognised (Prater, 1981; Teixeira et al., 2014; Woodward et al., 2024), limited work has been conducted to understand the specific roles of the different ecologies within the lower reaches of the intertidal zone.

The use of seagrass as a grazing resource for birds in the United Kingdom is thoroughly documented within species such as Brent geese (*Branta bernicla bernicla* and *Branta bernicla hrota*) and wigeon (*Mareca penelope*), yet there is little in the way of data that explicitly differentiates its role in supporting wider avian assemblages (Unsworth & Butterworth, 2021). The structure and complexity of seagrass habitats allows for increased abundance and diversity of fish and invertebrates when compared to areas of unvegetated sediment (Connolly, 1994; Connolly, 1997; Jenkins et al, 1997; Attrill et al. 2000; Jackson et al. 2006; Bertelli and Unsworth, 2014; Smale et al., 2019). It is therefore logical that an increased abundance and diversity of food sources would allow for increased avian abundance and diversity (Unsworth & Butterworth, 2021). The limited existing literature suggests that seagrass does influence waders and wildfowl other than herbivorous species, however these effects vary widely between species and location (Spruzen et al. 2008a; Spruzen et al., 2008b; Horn et al. 2020; Unsworth & Butterworth, 2021; Butterworth, 2022). As such, it is important to assess these relationships in further locations across a variety of species in order to build a more complete picture of the role seagrasses hold in avian ecology.

Prior to the 20th Century, seagrass would have carpeted much of Britain's subtidal sediment and the lower ranges of intertidal flats, especially within estuaries (Green et al., 2021). It is believed that historical seagrass levels in the UK may have been up to 11 times greater than current coverage (Green et al., 2021). Knowing how this vulnerable habitat is used by migratory birds would be beneficial for the research and conservation of both seagrass and avian species; especially given the great importance of British estuaries to avian populations (Prater, 1981; Stroud et al., 1990; Frost et al., 2019).

At the 14th Meeting of the Conference of the Parties (COP14) to the Convention on the Conservation of Migratory Species of Wild Animals (CMS) in Samarkand, Uzbekistan in February 2024, seagrasses were recognized as being important to a range of international migratory species. CMS documentation requested that party members create an inventory of migratory species which utilise seagrass habitats (CMS, 2023). In accordance with CMS guidelines and to further our understanding of seagrass ecosystem services, this study aims to begin identifying avian winter migrant species that use seagrass habitats in British estuaries and evaluate species-specific trends on the usage of intertidal seagrass versus unvegetated sediment habitats. This will aid in understanding the ecological role of intertidal seagrass in supporting wintering bird populations, particularly focusing on its function as a foraging habitat, and thereby contribute to a broader understanding of the ecological significance of seagrass in estuarine environments.

I hypothesise that wintering birds will make frequent use of intertidal seagrass due to enhanced foraging opportunities. However, I also expect that seagrass presence alone will not fully explain the birds' foraging patterns, as additional factors such as species-specific dietary strategies may play a role. Furthermore, I predict that these trends will vary between geographical locations due to regional differences in environment, highlighting the complex nature of estuarine ecosystems.

Methods

Study Sites

This study was conducted across two estuaries within Britain: Chichester Harbour (CH) on the border of Hampshire and West Sussex, and Milford Haven Waterway (MHW) in Pembrokeshire. These estuaries differ considerably in morphology (Appendix 1) but both are in the UK National Site Network (formerly Natura 2000 Network sites), designated as Special Protection Area (SPA) and Special Area of Conservation (SAC) under the Birds and the Habitats Directive respectively. The British Trust for Ornithology (BTO) conducts Wetland Bird Survey (WeBS) Low Tide Counts (LTC) in both estuaries. These two estuaries were chosen due to their national and international importance to overwintering birds and their varying ecological characteristics.

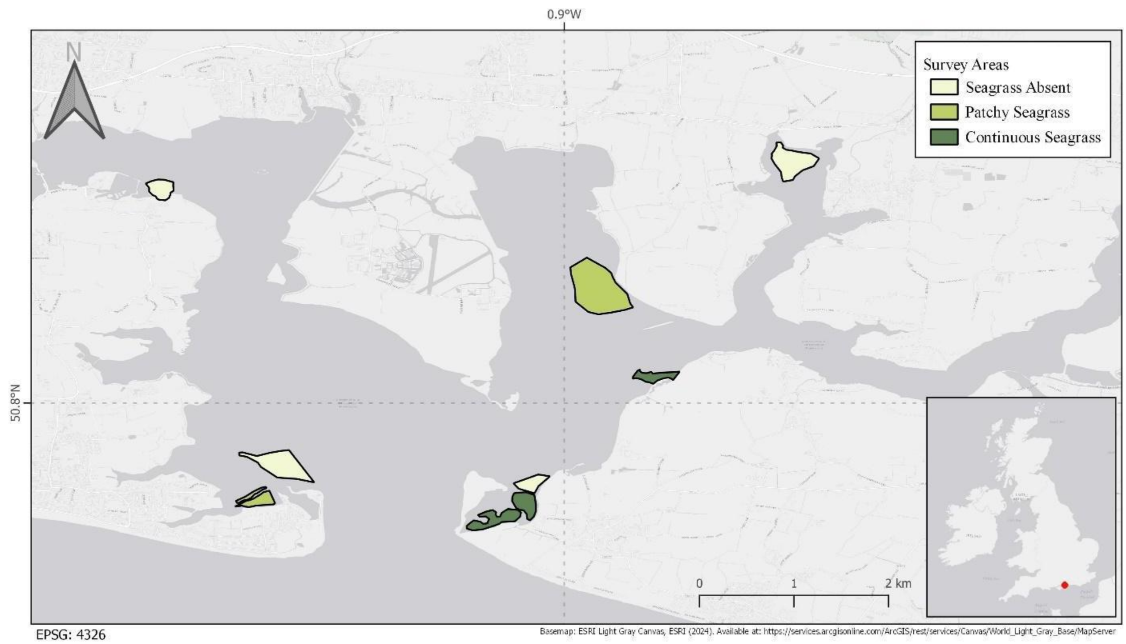


Figure 1. Chichester Harbour, with survey areas outlined. Location of Chichester Harbour within the broader UK context is displayed.

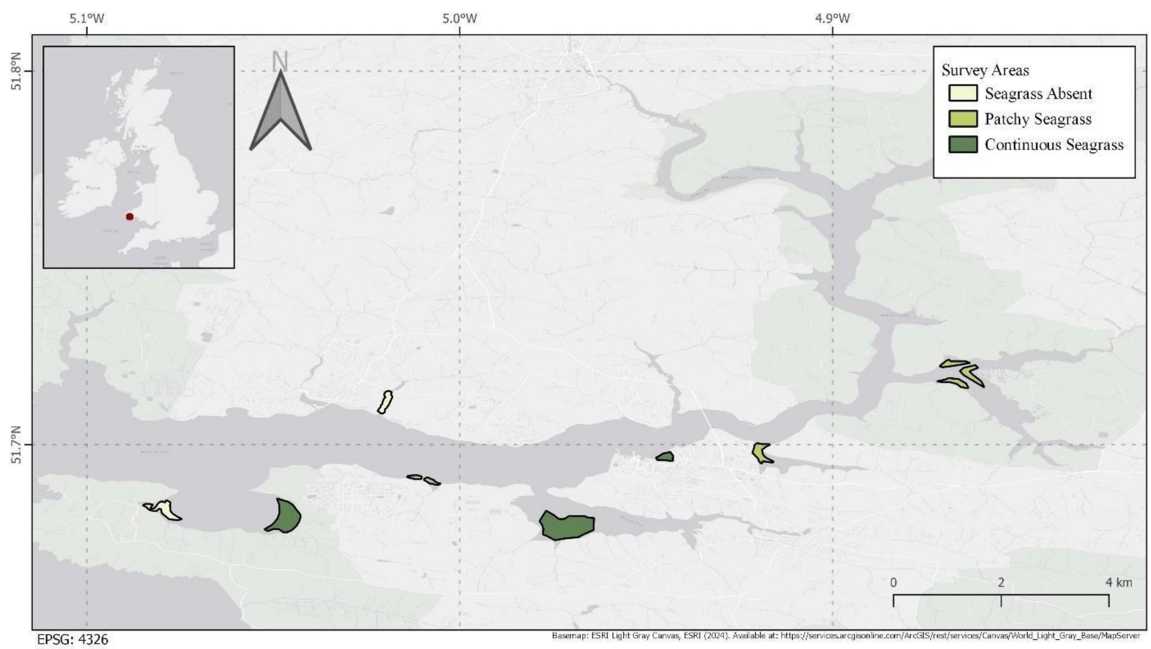


Figure 2. Milford Haven Waterway, with survey areas outlined. Location of Milford Haven Waterway within the broader UK context is displayed.

Selected sites were categorised by seagrass cover falling into three levels; unvegetated sediment, patchy seagrass, and continuous seagrass (Table 1). In this paper "seagrass" only refers to those in the genus Zostera; *Zostera marina* and *Zostera noltii*, unless specified otherwise. These were initially identified using current seagrass maps (Rice et al., 2022) and the citizen science project Seagrass Spotter (Unsworth et al., 2018). An unexpected challenge was encountered when selecting sites in MHW with an absence of seagrass as there were more areas with seagrass biomass than those which were mapped; only two suitable sites were selected compared to the intended three.

Table 1. Table of sampling design.

Region	Level of seagrass cover	Site	Number of Surveys
Chichester Harbour	Unvegetated	1	7
		2	8
		3	8
		4	8
	Patchy	5	7
		6	8
	Continuous	7	7
		8	7
		9	7
Milford Haven Waterway	Unvegetated	1	8
		2	8
	Patchy	3	8
		4	8
		5	8
	Continuous	6	8
		7	8
		8	8
Total number of surveys:			131

Surveys took place in CH in February 2024 and in MHW in March 2024. Timing limitations of this study meant that only the end of the overwintering bird season could be surveyed. Visible seagrass biomass was absent in CH by the start of February. This is typical of seagrass exhibiting an annual life history strategy, whereby seagrass completes its life cycle within a few months and shoots do not survive over winter (Hyeon Kim et al., 2014). This strategy is common in areas subject to regular environmental disturbances, such as Chichester Harbour, where seagrass meadows experience intensive grazing by Brent geese. In contrast, intertidal seagrass in MHW exhibited a perennial life history strategy where shoots survive over winter. This enabled further comparison between a region where seagrass biomass is highly seasonal and one where it experiences minimal changes throughout the year.

The lack of visible seagrass biomass in CH introduced some limitations in patchy sites as the surveyor had to rely on existing mapped areas (Rice et al., 2022), local knowledge from the Chichester Harbour Conservancy (P. Hughes, personal communication, February 2024), and changes in sediment appearance, to determine where the extent of the seagrass and non-seagrass patches were. With this local ecological knowledge available, the likelihood of significant inaccuracy in this aspect was minimised.

Bird counts

Bird counts were conducted daily according to a "look-see" methodology (Bibby et al. 2000), already used in the established WeBS methodology, with the intention to survey the sites with an equal number of repetitions. The surveyor observed the sites from a vantage point, from which the whole site could be viewed with minimal obstruction. The surveys were carried out during the two hours either side of low tide. Some wading bird species such as the dunlin (*Calidris alpina*) are heavily influenced by tidal height (Nehls & Tiedemann, 1993) and so for each site the surveys were performed at varying times within these two hours. The surveys consisted of 15 minute observation periods using binoculars and a spotting scope to record data on the variety of bird species, their abundance, and behavioural state of foraging or resting. This length of time was selected to minimise observer error by way of double counting while ensuring enough time to accurately identify and count all individuals (Fuller & Langslow, 1984; Bibby et al., 2000).

All eight sites in MHW were surveyed eight times each. Four of the sites in CH were surveyed eight times, but five were surveyed seven times due to unsuitable weather conditions (Table 1). Only observations of feeding birds were carried forward into further analysis. This method allowed observation of a wide range of avian species with minimal disturbance by viewing from a distance. It facilitated surveys over large areas without the surveyor having to enter the intertidal zone and therefore reducing risk of danger. However, the presence of creeks in some sites did create minor areas obscured from the eyeline, and therefore any species that have a preference for foraging within creeks may have been underrepresented (Bibby et al. 2000). Additionally, while it would have been ideal to survey sites of equal area, sites varied greatly in size from five to 60 hectares. Selecting smaller sites within suitable areas to ensure consistent size would have introduced implicit bias to the sample design, therefore site size was not standardised and area was instead offset to account for this variance (Zuur et al., 2009).

WeBS Data

Data were provided by WeBS (Appendix B) encompassing CH as well as MHW, referred to as the Cleddau Estuary. It included raw monthly bird count totals, as well as peak and mean counts and densities for each species across the defined sectors. Density in this data was based on the area of each species' preferred habitat within each sector, including non-tidal, intertidal, subtidal, or combined habitat types. This dataset lacked environmental data and additional variables, which limited its suitability for fine-scale or species-specific analyses; however, it still offered valuable broad-scale insights into species that may be utilising seagrass areas.

This data was processed using QGIS 3.16.3 (QGIS Development Team, 2024). The boundaries of the BTO WeBS sites were overlapped with current mapped seagrass polygons (Rice et al., 2022) and presence data from SeagrassSpotter project (Unsworth et al., 2024) and categorised into sites with and without seagrass present. The mapping information was not accurate enough to calculate area cover, so in lieu of percentages a presence or absence value was applied to each site as a binary factor.

Attribute tables were exported to R for further analysis.

Statistical Analyses

Statistical analyses of species-level survey data and WeBS data were conducted in R4.3.2. (R Core Team, 2023), and multivariate analysis at the assemblage level was performed using PRIMER 7 (Clarke and Gorley, 2015). Brent goose, mute swan (*Cygnus olor*) and wigeon were excluded from both the survey and WeBS datasets, as their herbivorous diets and known reliance on seagrass (Unsworth and Butterworth, 2021) rendered further analysis of habitat preference unnecessary.
For assemblage-level multivariate analysis in PRIMER 7, count data were square root transformed to reduce the influence of highly abundant species and to better visualise patterns across taxa with varying abundances. A Bray-Curtis similarity matrix was then created, which is well-suited for ecological count data due to its effective handling of zeros and emphasis on community composition (Clarke and Warwick, 2001). Non-metric Multidimensional Scaling (nMDS) was applied to the resemblance matrix to visualise patterns among samples without assuming multivariate normality, which is advantageous for ecological datasets.

To compare species richness between seagrass and unvegetated sediment habitats, a Welch Two Sample t-test was used. To examine differences in species abundance across regions and habitat types, generalised linear mixed models (GLMMs) were employed due to their suitability for count data and ability to incorporate random effects (Bolker et al., 2008; Zuur et al., 2009).

A subset of the full dataset was created, focusing on the 15 most abundant species, to explore ecological relationships in more detail. Predictor variables included tidal state (ebb or flow), wind force (Beaufort scale), precipitation, temperature, cloud cover, and time of day. Bird counts were compared across habitat types (seagrass vs. unvegetated sediment), as well as seagrass coverage categories: unvegetated, patchy, and continuous. Within patchy sites, additional comparisons were made between birds observed on seagrass versus unvegetated patches.

GLMMs were fitted for the 15 species using Poisson, zero-inflated Poisson, negative binomial, and zero-inflated negative binomial distributions (Zuur et al., 2009). The R package glmmADMB was used as it supports zero-inflated models with random effects (Fournier et al., 2012; Skaug et al., 2016), which is useful for modelling ecological count data. Models were compared with and without a zero-inflation term using Akaike Information Criterion (AIC) values (Akaike, 1973) and by examining the zero-inflation parameter estimate to assess the presence of excess zeros.

Random effects of date and site were included in all models, along with an offset for site area. Because GLMMs with count distributions do not directly return density values, bird abundance was used as the response variable, and the log-transformed site area offset allowed estimation of bird density across sites. Environmental variables were tested for correlation with bird abundance and models were compared using AIC, log-likelihood, and residual analysis. Variables that did not show a significant effect or did not influence the significance of other predictors were excluded from the final models. Where interaction terms were included, main effects were interpreted cautiously and not in isolation (Field et al., 2012).

To assess regional variation in species richness by habitat type, Wilcoxon rank-sum tests were applied. A generalised linear model (GLM) was used to assess whether seagrass presence affected bird abundance on a broader scale, and whether this effect varied across species. Habitat preference (non-tidal, intertidal, subtidal, all-habitats) was included as an interaction term. However, due to the lack of detailed environmental variables in the WeBS dataset, further species-specific analyses were not conducted, and interpretation was limited to the assemblage level.

Results

A total of 15467 individual bird sightings were recorded over 131 surveys, though it is likely that some of these will have been re-counts of the same individuals. The mean number of individual birds counted per 15 minute survey was 118.

Including birds that were resting, dunlin were the most abundant species overall with 3738 individuals observed. The second most numerous species was the Brent goose with 2502 individuals observed. It is likely that some of these were re-counts of the same individuals.

33 species were observed feeding across all sites over the two months of surveys. 24 species were recorded within MHW sites with five species unique to the region, and 28 species were recorded within CH sites with nine species unique to the region.

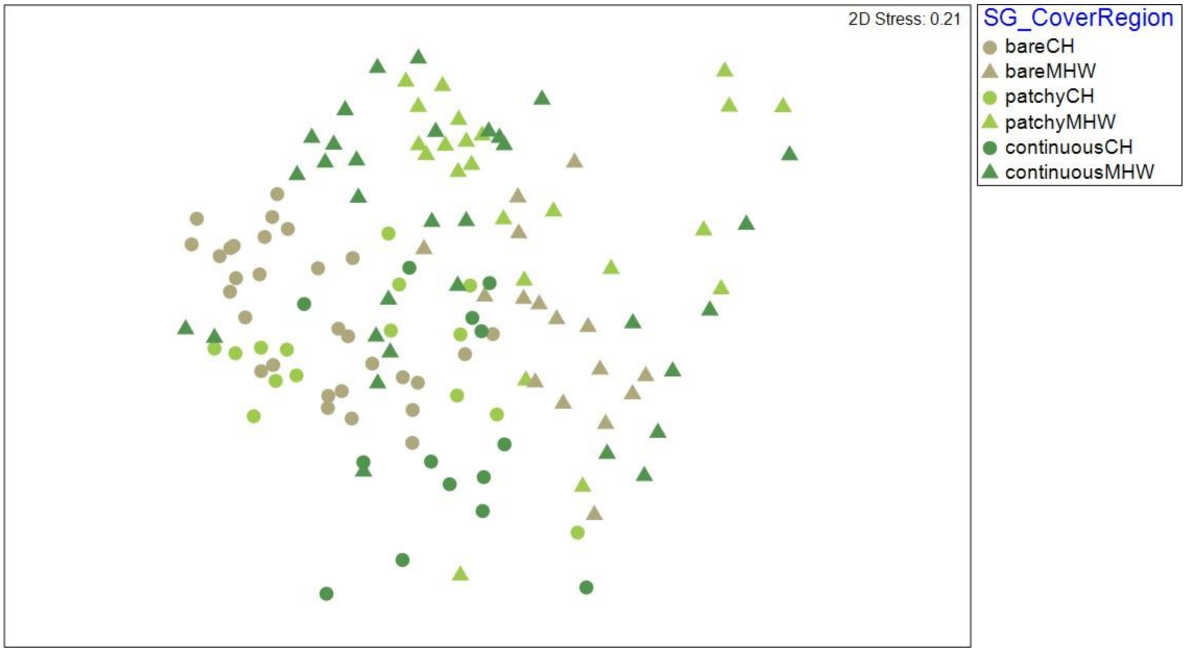


Figure 3. 2D non-metric multi-dimensional scaling (nMDS) of avian community composition across Chichester Harbour (CH) and Milford Haven Waterway (MHW), comparing levels of seagrass cover (bare, patchy, continuous). A stress value of 0.21 indicates that this model captures the general structure of the data but there is noticeable distortion. Plot produced in PRIMER 7.

Do birds make use of intertidal seagrass in winter foraging?

Across all areas, 28 species of birds were observed feeding at least once on seagrass habitat compared to 30 species observed on unvegetated sediment. Twenty-one of the species observed were listed on the CMS species list, including 18 of the 28 species observed foraging on the seagrass habitat.

Figure 4. Curlew (*Numenius arquata*) on unvegetated sediment; Redshank (*Tringa totanus*) on intertidal seagrass. Photos by the author.

Table 2. Species observed on intertidal seagrass habitat (SG) and unvegetated sediment (UV) during surveys in Chichester Harbour and Milford Haven Waterway. Species in bold are listed by the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 2015).

Species		SG	UV
Wildfowl			
brent goose, dark-bellied	***Branta bernicla bernicla***	**X**	**X**
brent goose, light-bellied	***Branta bernicla hrota***	**X**	
mallard	***Anas platyrhynchos***	**X**	**X**
mute swan	***Cygnus olor***	**X**	
shelduck	***Tadorna tadorna***	**X**	**X**
teal	***Anas crecca***	**X**	**X**
wigeon	***Mareca penelope***		**X**
Gulls and Terns			
black-headed gull	*Chroicocephalus ridibundus*	X	X
common gull	*Larus canus*	X	X
great black-backed gull	*Larus marinus*	X	X
herring gull	*Larus argentatus*	X	X
lesser black-backed gull	*Larus fuscus*	X	X
mediterranean gull	***Ichthyaetus melanocephalus***		**X**
Waders			
avocet	***Recurvirostra avosetta***		**X**
bar-tailed godwit	***Limosa lapponica***	**X**	
black-tailed godwit	***Limosa limosa***	**X**	**X**
curlew	***Numenius arquata***	**X**	**X**
dunlin	***Calidris alpina***	**X**	**X**
greenshank	***Tringa nebularia***	**X**	**X**
grey plover	***Pluvialis squatarola***	**X**	**X**
knot	***Calidris canutus***	**X**	**X**
oystercatcher	*Haematopus ostralegus*	X	X
redshank	***Tringa totanus***	**X**	**X**
ringed plover	***Charadrius hiaticula***	**X**	**X**
sanderling	***Calidris alba***	**X**	**X**
sandpiper	***Actitis hypoleucos***		**X**
turnstone	***Arenaria interpres***	**X**	**X**
whimbrel	***Numenius phaeopus***	**X**	**X**
Herons and Egrets			
grey heron	*Ardea cinerea*	X	X
little egret	*Egretta garzetta*	X	X

Other Birds			
cormorant	*Phalacrocorax carbo*	X	
crow	*Corvus corone*	X	X
jackdaw	*Corvus monedula*	X	X
rook	*Corvus frugilegus*		X

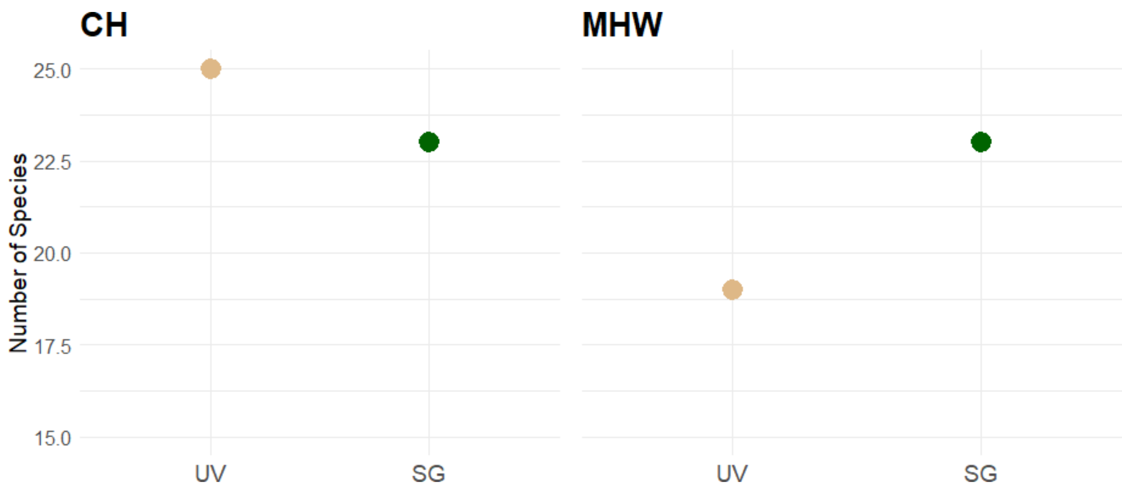


Figure 5. Species richness in Chichester Harbour (CH) and Milford Haven Waterway (MHW) on intertidal seagrass (SG) and unvegetated sediment (UV). Error bars are absent because species richness was calculated using cumulative results from all surveys.

Species richness did not differ significantly between seagrass and unvegetated sediment in either region (for both CH and MHW: Kruskal-Wallis chi-squared = 1, df = 1, p-value = 0.3173). Bird density was greater on seagrass habitats in CH (estimate = 0.378, p = 0.0179) but not in MHW (estimate = -0.0162, p = 0.924). Within patchy sites in CH there was an overall trend towards greater density on seagrass patches (estimate = 0.374, p = 0.026) but there was no such trend in MHW (estimate = 0.051, p = 0.8).

How do densities differ between species?

Observations of density on seagrass varied greatly between species. Fifteen species were selected for further analysis due to consistency of observations and suitability for the study, omitting herbivorous birds. Some species exhibited different densities and responses in each region (Fig. 8). Black-headed gull (*Chroicocephalus ridibundus*), dunlin, grey plover (*Pluvialis squatarola*), and knot (*Calidris canutus*) were more abundant in CH; whereas herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fucus*), crow (*Corvus corone*), and jackdaw (*Corvus monedula*) were more abundant in MHW.

Three species were only observed feeding on seagrass habitats, whereas five species were observed only on unvegetated sediment, including those within patchy sites (Table 3). Species only observed on seagrass habitats were bar-tailed godwit (*Limosa lapponica*), cormorant (*Phalacrocorax carbo*), and mute swan. Species only observed on unvegetated habitats were avocet (*Recurvirostra avosetta*), mediterranean gull (*Ichthyaetus melanocephalus*), rook (*Corvus frugilegus*), sandpiper (*Actitis hypoleucos*), and wigeon. These species were not included for species specific statistical significance as there were too few observations, except for mute swan which are herbivorous as thus excluded from this study. Thirty species of birds were observed feeding at least once within seagrass habitats across both regions. This is compared to 36 species observed feeding at least once on unvegetated sediment.

Table 3. Species showing effects on density due to seagrass presence or absence. See Appendix C for statistical details.

Greater overall densities on SG	Mixed SG Associations	Greater overall densities on UV
Crow Little egret Jackdaw	Redshank	Dunlin Herring gull

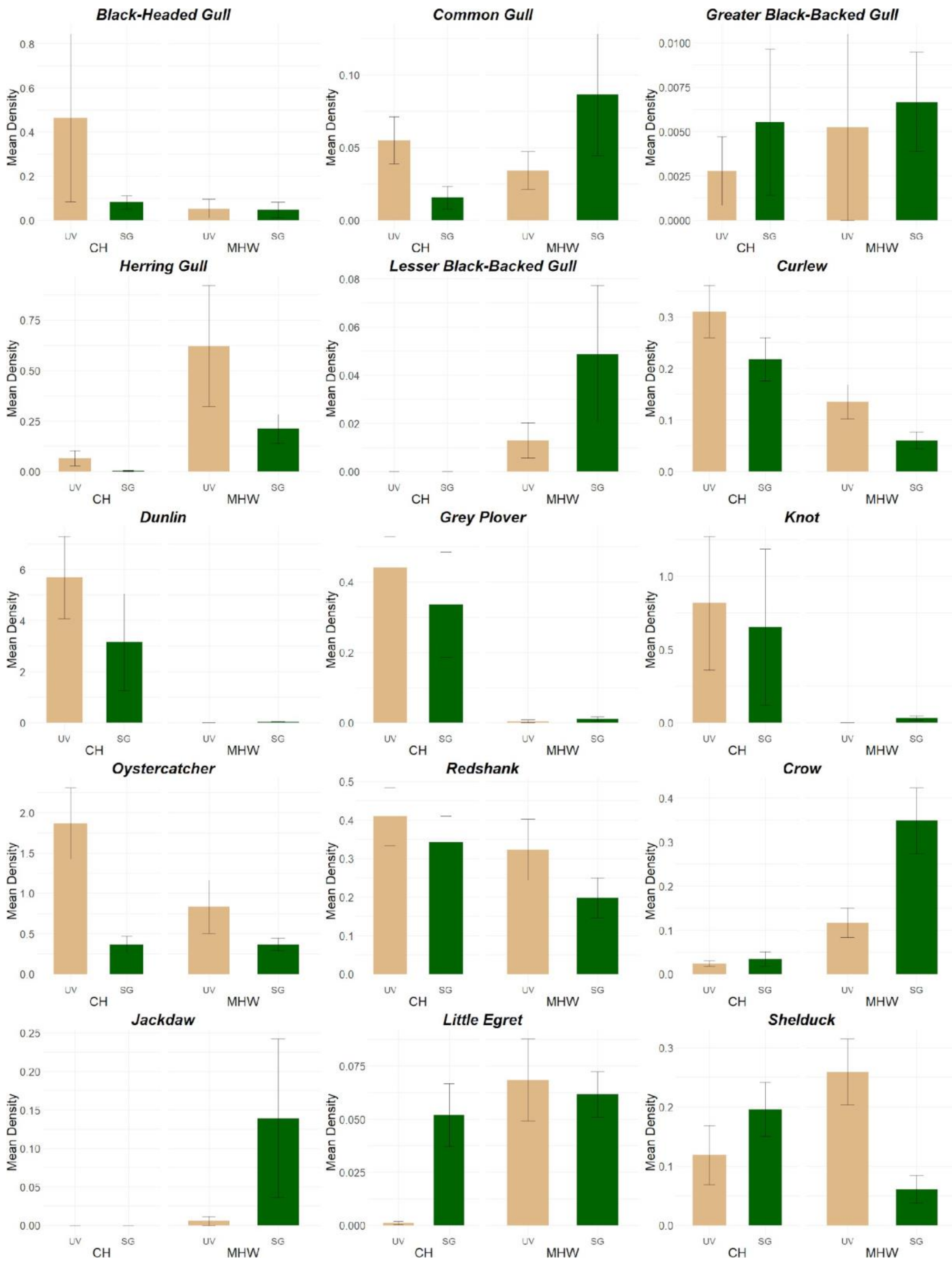


Figure 6. Density of avian species on intertidal seagrass habitat (SG) and unvegetated sediment (UV) within sites across Chichester Harbour (CH) and Milford Haven Waterway (MHW). Error bars indicate standard deviation, and their absence signifies that the data consists of a single record.

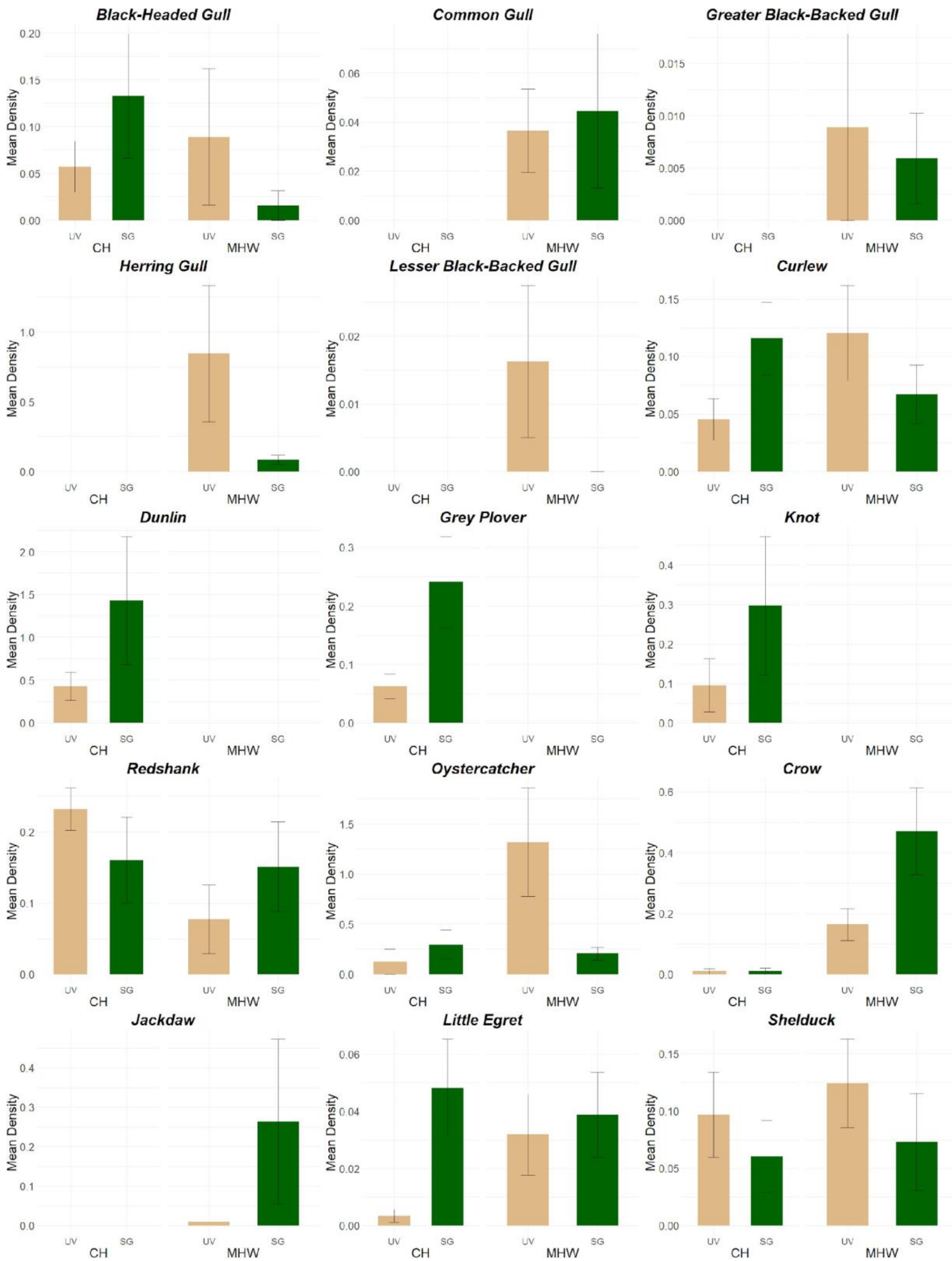


Figure 7. Density of avian species within sites containing patchy seagrass, on intertidal seagrass (SG) and unvegetated sediment (UV) patches, across Chichester Harbour (CH) and Milford Haven Waterway (MHW). Error bars indicate standard deviation, and their absence signifies that the data consists of a single record.

What other factors are involved in foraging choices?

A detailed summary of the environmental variables associated with changes in species abundance can be viewed in Appendix D.

The density of six species (herring gulls, dunlin, oystercatcher, redshank, jackdaw, shelduck (*Tadorna tadorna*) were influenced by the tide state in one or both regions (Appendix D), with four of these species (dunlin, oystercatcher, redshank, shelduck) showing a notable interaction between tide and seagrass presence. The effect of tide on density of redshank and oystercatcher in both regions, and dunlin in CH, was mitigated on seagrass habitat meaning that density was more stable across both tide states on seagrass.

Temperature was an influential factor for black-headed gulls in CH, and for herring gulls and redshank in MHW. Similarly, wind conditions affected the density of herring gulls in MHW and curlew in CH, as well as oystercatcher in patchy sites within CH. Cloud cover influenced density in grey plover and dunlin but only within patchy sites in CH. The density of common gulls in CH was found to have a positive correlation with the time of day.

Other variables that were not measured, but may have had undetected influence, were surrounding habitats, levels of disturbance, and amount of the site bordering a main water channel.

WeBS Data

Fifty-eight species were recorded in the WeBS data across CH and Cleddau Estuary (MHW) excluding brent geese and wigeon. Fifty species were recorded in sectors with seagrass present, and 55 species were recorded in sectors with seagrass absent (Table 4). It should be noted however that the majority of the sectors were a mosaic of multiple habitats including saltmarsh, mudflat, intertidal and subtidal seagrass, and subtidal areas.

Table 4. Species of birds recorded by WeBS volunteers (Appendix B) within Chichester Harbour and Milford Haven Waterway (Cleddau Estuary), across sectors with and without seagrass present. Species presence is noted by an X in the applicable location.

Species		Chichester Harbour		Cleddau Estuary	
		SG Present	SG Absent	SG Present	SG Absent
Wildfowl					
black swan	*Cygnus atratus*		X		
canada goose	*Branta canadensis*		X	X	X
greylag goose	*Anser anser*			X	X
eider	*Somateria mollissima*	X			
gadwall	*Mareca strepera*		X		
goldeneye	*Bucephala clangula*	X	X		
goosander	*Mergus merganser*		X		
mallard	*Anas platyrhynchos*	X	X	X	X
mute swan	*Cygnus olor*	X	X	X	X
pintail	*Anas acuta*	X	X	X	X
red-breasted merganser	*Mergus serrator*	X	X		
shelduck	*Tadorna tadorna*	X	X	X	X
shoveler	*Spatula clypeata*	X	X	X	X
teal	*Anas crecca*	X	X	X	X
tufted duck	*Aythya fuligula*	X	X		
Gulls and Terns					
black-headed gull	*Chroicocephalus ridibundus*	X	X	X	X
common gull	*Larus canus*	X	X	X	X
great black-backed gull	*Larus marinus*	X	X	X	X
herring gull	*Larus argentatus*	X	X	X	X
lesser black-backed gull	*Larus fuscus*	X	X	X	X
mediterranean gull	*Ichthyaetus melanocephalus*		X	X	X
sandwich tern	*Thalasseus sandvicensis*	X	X		
Waders					
avocet	*Recurvirostra avosetta*	X	X		
bar-tailed godwit	*Limosa lapponica*	X	X	X	X
black-tailed godwit	*Limosa limosa*	X	X	X	X
common sandpiper	*Actitis hypoleucos*	X	X		X
curlew	*Numenius arquata*	X	X	X	X
dunlin	*Calidris alpina*	X	X	X	X
golden plover	*Pluvialis apricaria*	X	X	X	
green sandpiper	*Tringa ochropus*		X		X

greenshank	*Tringa nebularia*	X	X	X	X
grey plover	*Pluvialis squatarola*	X	X	X	X
jack snipe	*Lymnocryptes minimus*			X	X
knot	*Calidris canutus*	X	X		
lapwing	*Vanellus vanellus*	X	X	X	X
oystercatcher	*Haematopus ostralegus*	X	X	X	X
purple sandpiper	*Calidris maritima*		X		
redshank	*Tringa totanus*	X	X	X	X
ringed plover	*Charadrius hiaticula*	X	X	X	X
sanderling	*Calidris alba*	X			
snipe	*Gallinago gallinago*	X	X	X	X
spotted redshank	*Tringa erythropus*	X	X		
turnstone	*Arenaria interpres*	X	X	X	X
whimbrel	*Numenius phaeopus*	X	X		X
Herons and Egrets					
grey heron	*Ardea cinerea*	X	X	X	X
great white egret	*Ardea alba*				X
little egret	*Egretta garzetta*	X	X	X	X
Other Waterbirds					
coot	*Fulica atra*	X	X		
moorhen	*Gallinula chloropus*	X	X		X
cormorant	*Phalacrocorax carbo*	X	X	X	X
black-throated diver	*Gavia arctica*		X		
great northern diver	*Gavia immer*	X	X	X	X
red-throated diver	*Gavia stellata*		X		
great crested grebe	*Podiceps cristatus*	X	X	X	X
little grebe	*Tachybaptus ruficollis*	X	X	X	X
slavonian grebe	Podiceps auritus	X			
kingfisher	*Alcedo atthis*	X	X		X
water rail	*Rallus aquaticus*	X	X		

From this WeBS data, the difference in number of species found in sectors with or without seagrass was not significant in the CH ($w = 81233$, $p = 0.171$) or Cleddau Estuary (MHW) ($w = 45627$, $p = 0.763$).

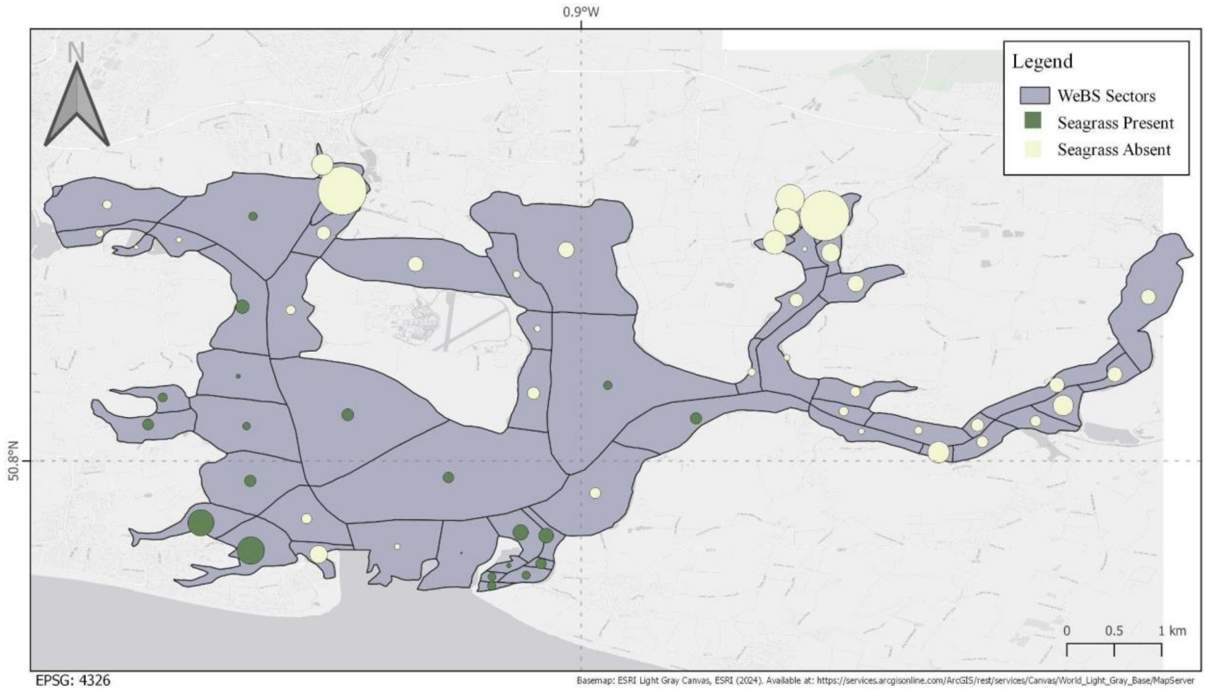
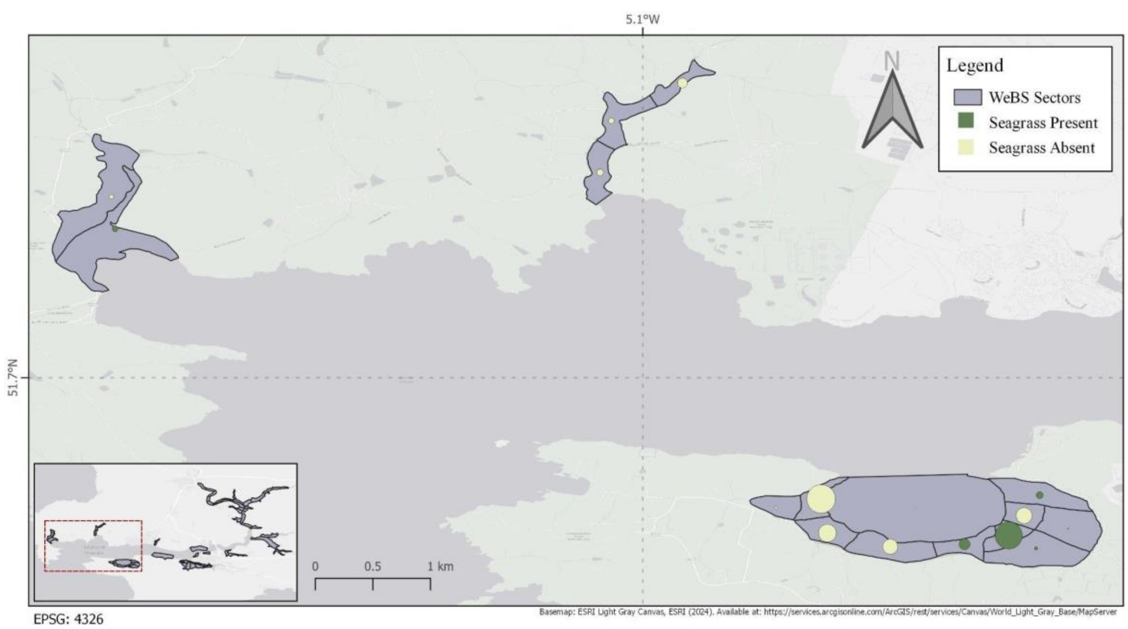
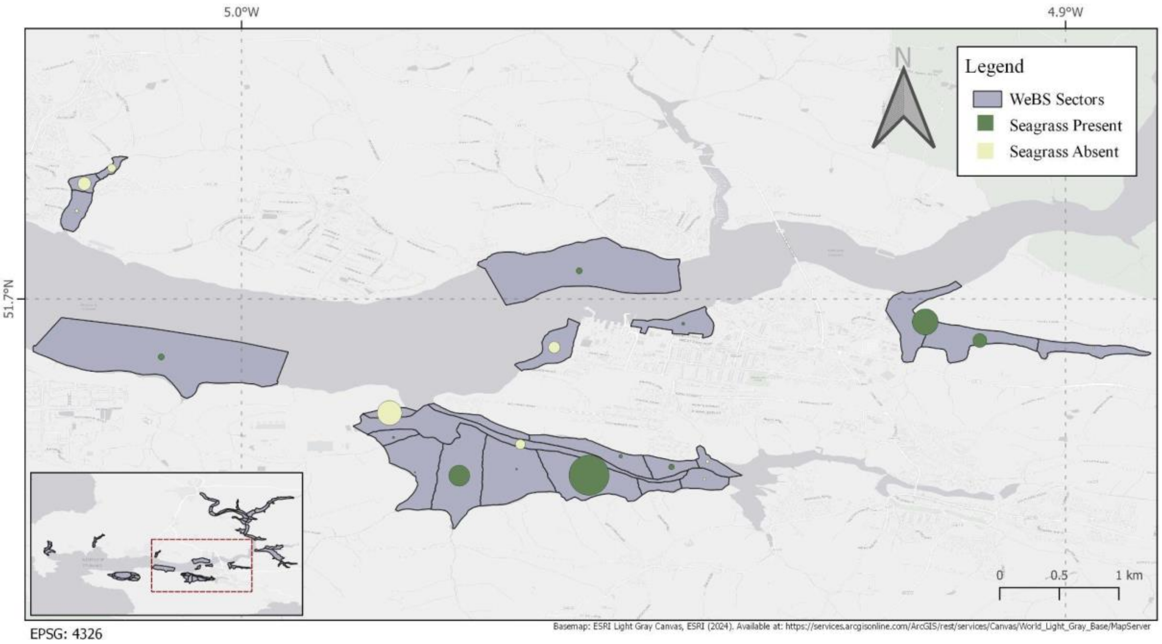


Figure 8. Densities of birds within Chichester Harbour across sectors with and without seagrass present, from WeBS data (Appendix B). Size of point represents the mean cumulative densities of all species observed per survey. Colour is representative of the presence or absence of seagrass within the sector but does not indicate the amount or the health of the seagrass.

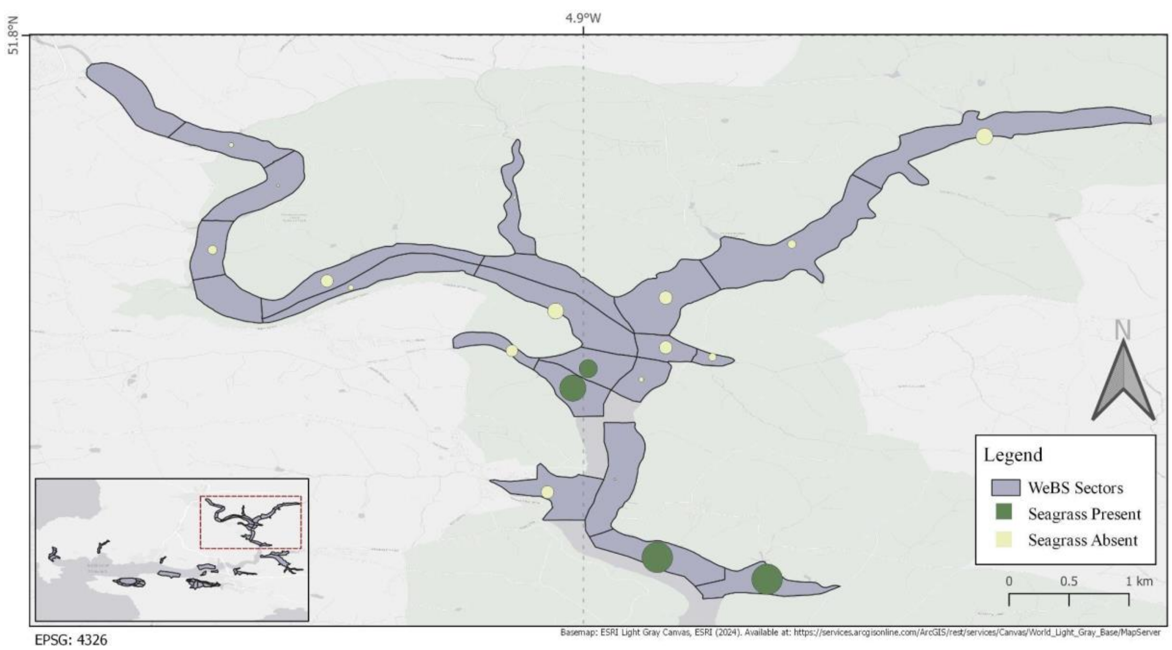
a)



b)


5.0°W
4.9°W
51.7°N
Legend
WeBS Sectors
Seagrass Present
Seagrass Absent
N
0
0.5
1 km
EPSG: 4326
Basemap: ESRI Light Gray Canvas, ESRI (2024). Available at: https://services.arcgisonline.com/ArcGIS/rest/services/Canvas/World_Light_Gray_Base/MapServer

c)


4.9°W
51.8°N
N
Legend
WeBS Sectors
Seagrass Present
Seagrass Absent
0
0.5
1 km
EPSG: 4326
Basemap: ESRI Light Gray Canvas, ESRI (2024). Available at: https://services.arcgisonline.com/ArcGIS/rest/services/Canvas/World_Light_Gray_Base/MapServer

d)

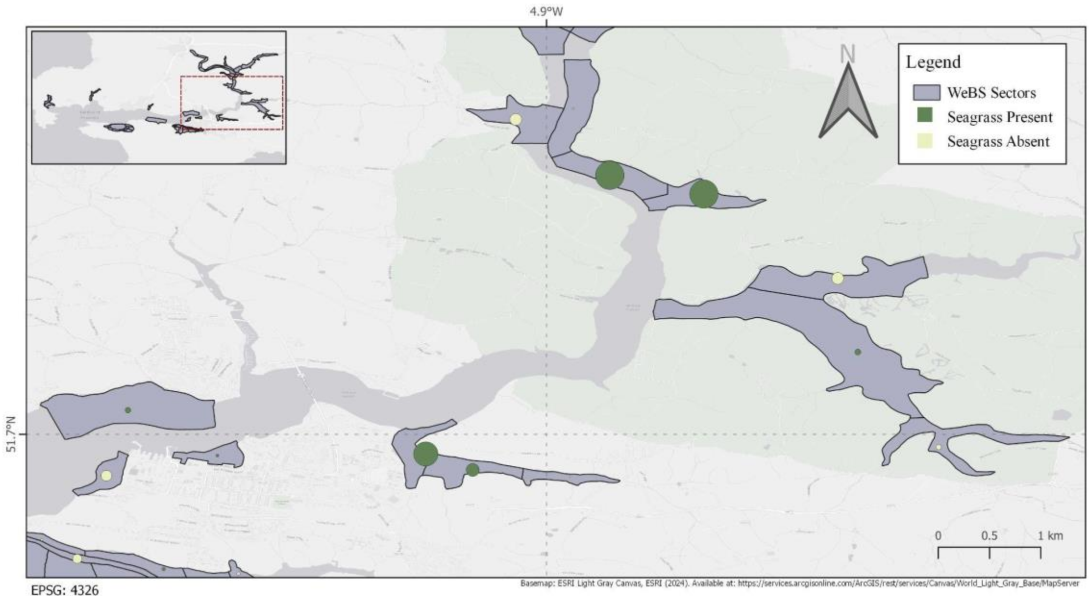


Figure 9. Densities of birds within Milford Haven Waterway across sectors with and without seagrass present, from WeBS data (Appendix B). Size of point represents the mean cumulative densities of all species observed per survey. Colour is representative of the presence or absence of seagrass within the sector but does not indicate the amount or the health of the seagrass.

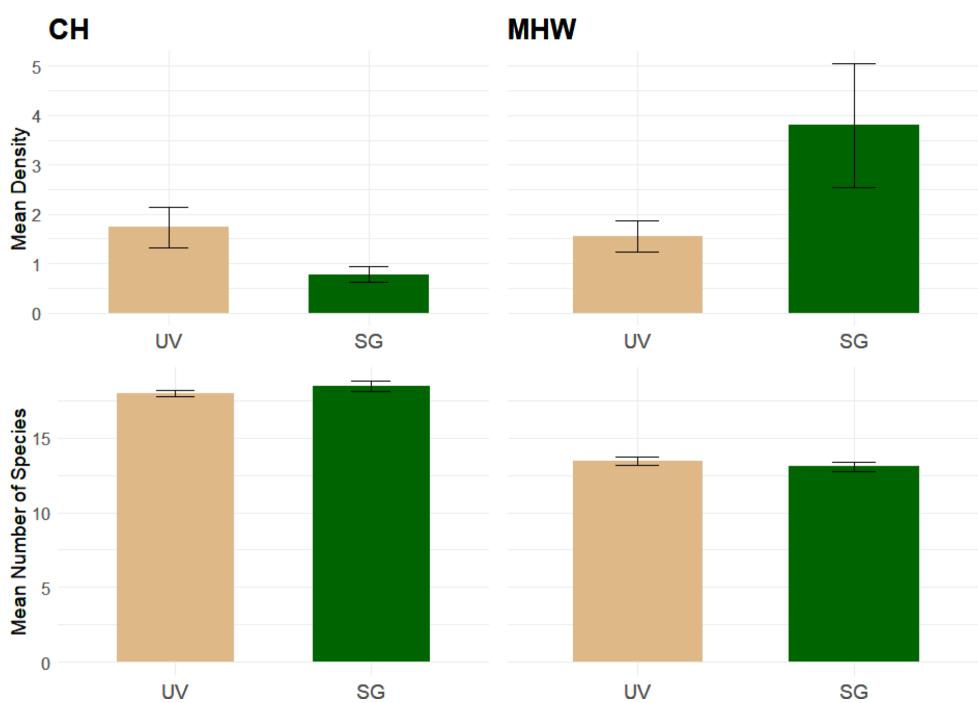


Figure 10. Mean bird density and mean number of species per WeBS sector in the Chichester Harbour (CH) and Milford Haven Waterway (MHW). Data from WeBS (Appendix B). Error bars indicate standard deviation, and their absence signifies that the data consists of a single record.

There is no evidence that seagrass presence alone influenced mean density of birds within CH (estimate = -1.529, p = 0.243) and Cleddau Estuary (estimate = -0.855, p = 0.506), though the effect of seagrass presence varied depending on species. The model with species as an interaction term provided a significantly better fit than the reduced model without species included ($\chi^2(76) = 801.27$, $p < 2.2e-16$).

Out of the 58 observed species, three showed evidence of a positive association with seagrass. Great northern diver (*Gavia immer*) in Cleddau Estuary showed moderate evidence that seagrass presence had a positive effect on mean density (great northern diver: estimate = 4.115, p = 0.036). In CH, moorhen (*Gallinula chloropus*) and tufted duck (*Aythya fuligula*) showed moderate evidence that seagrass had a positive effect on mean density (moorhen: estimate = 4.116, p = 0.019; tufted duck: estimate = 4.827, p = 0.016). The number of observations of these species was minimal. Moorhen had five observations on unvegetated sediment, and only one on seagrass. Both tufted duck and great northern diver had one observation in a site with seagrass and one in a site without.

Discussion

Studies on the foraging behaviour of coastal birds rarely consider the role of varied habitat types leading to a lack of knowledge of how specific habitat types, such as seagrass, may or may not influence particular species' populations (Unsworth & Butterworth, 2021). As marine habitats are degraded and decline in coverage, their role in supporting avian biodiversity is therefore not considered. Here I provide an assessment of how intertidal coastal bird assemblages utilise seagrass meadows in areas characterised by annual and perennial seagrass populations. Birds were abundant in intertidal seagrass areas across both regions, with 28 species recorded, primarily engaging in foraging behavior. As hypothesised, the evidence from these surveys indicates that seagrass can be regarded as an important foraging habitat for overwintering birds of numerous species. Data from the BTO Wetland Bird Survey (WeBS) recorded 50 bird species in survey sectors containing seagrass, alongside other habitats such as saltmarsh, mudflats, mixed sediments, and sea walls. However, the mixed composition of these sectors limits the utility of the data for addressing the specific research questions, as insufficient environmental information was available to isolate the effects of variables beyond seagrass presence. Despite these limitations, such datasets hold potential for broader-scale analyses - at the estuary level, for example - exploring associations between seagrass and foraging bird distributions.

Regional Differences

As expected there were numerous regional differences noted between CH and MHW. These comprised varying bird densities and seagrass associations

Density

Differences in densities of *Larus* gulls (black-headed gull, lesser black-backed gull, herring gull) between the MHW and CH regions may reflect varying trends in regional breeding populations; the birds wintering in these areas typically originate from distinct populations (Banks et al., 2009). During the winter, UK numbers of black-headed gulls are supplemented by birds from northern and eastern Europe (Mitchell et al., 2004). Densities are typically highest in south-eastern England, including the Solent. As such it is no surprise that densities of this species were greater in CH, within the Solent area, than MHW during these surveys. Conversely, as the surveys within MHW took place throughout March only, the population of lesser black-backed gulls in MHW may have been inflated by an influx of breeding birds which begin to arrive at their colonies from March onwards (Burger et al., 2020). Pembrokeshire has two large breeding colonies of lesser black-backed gulls on the islands of Skokholm and Skomer (Mitchell et al., 2004), which are only 8 km and 12 km respectively from the entrance of MHW. Herring gull coastal breeding populations have decreased across the UK with birds increasingly breeding in urban areas (Mitchell et al., 2004), however during the non-breeding season birds still mainly select marine intertidal habitats for foraging (O'Hanlon et al., 2022). Evidence suggests that there is movement west towards Wales within some wintering herring gull populations (Burton et al., 2013), therefore densities would have been bolstered in MHW by these migratory individuals.

Three species of wader showed far greater densities in CH than MHW. CH is recognised as being internationally important for overwintering dunlin and grey plovers, hence the greater densities observed within CH. Knot are not considered qualifying features of the Chichester Harbour and Langstone Harbours SPA but the majority of the UK wintering populations are on the eastern side of the country meaning MHW sees comparatively low numbers (Wernham et al., 2002).

Seagrass

Corvids were not initially expected to be of interest due to limited literature on UK corvids using estuarine intertidal areas. However, carrion crow were frequently observed foraging within the intertidal zone during this study, aligning with previous reports of similar behaviour in Poole Harbour (Hopper, 2009) and Japan (Hori & Noda, 2007). Both crows and jackdaws showed greater densities on intertidal areas in MHW and evidence from this study suggests that this variation in density could be partially explained due to the presence of seagrass biomass.

Corvids are restricted to foraging above the waterline (Tangren, 1982; Robinette & Ha, 2000), which limits their available foraging time in intertidal zones. Both crows and jackdaws showed positive associations with foraging on seagrass, which provided stability to the intertidal sediment and an elevated area to stay dry (Potouroglou et al., 2017). This behaviour was also observed in Poole Harbour, where crows used rocks and macro-algae to forage intertidally while avoiding soft sediment (Hopper, 2009). While it remains unclear what the crows were feeding on, closely related species making use of the same environments have been observed preying on bivalves, gastropods, and crabs (Berrow et al., 1992; Robinette & Ha, 2000), inferring they exploit similar prey. Seagrass enhances the abundance and diversity of these macroinvertebrates

(Attrill et al. 2000; Jackson et al. 2006; Smale et al., 2019), offering potentially more accessible foraging resources for crows. Though minimally documented using intertidal zones (Berrow, et al., 1991), evidence suggests that jackdaws forage within intertidal habitats sporadically. Within this study, this usage was highly site-specific and positively associated with seagrass, suggesting irregular but noteworthy use of seagrass habitats.

These behaviours appear to be confined to perennial seagrass habitats, as no association with seagrass was detected in CH where the annual seagrass biomass was not present. Additionally, crows show regional variations in diet and foraging specialisations (Madge, 2020), as such seagrass habitats may only be used by populations that are behaviourally adapted for them. These findings imply that seagrass provides coastal populations of crows in Pembrokeshire access to increased prey supply and foraging resources over winter when terrestrial food sources may be more scarce. Seagrass habitats provide stable, elevated areas of sediment (Potouroglou et al., 2017) which offer efficient foraging without the need to navigate exposed mud. There may be further populations of UK corvids that have behaviourally adapted to exploit intertidal habitats, similar to the Northwestern crow (*Corvus brachyrhynchos caurinus*) in North America (Tangren, 1982; Robinette & Ha, 2000; Hechler, 2021). Further research is needed to quantify the role of intertidal foraging in the diet of British coastal corvid populations, and whether seagrass biomass provides foraging opportunities year-round across broader regions.

Herring gulls were one of three species showing a negative association with seagrass. While known for scavenging in urban areas, they primarily forage in intertidal zones with a varied diet of fish, bivalves, crustaceans, and fisheries' discards (Ewins et al., 1994; Kubetzki & Garthe, 2003).
With such flexibility, no clear dietary reason explains their negative association with seagrass. Due to their size and kleptoparasitic tendencies (Brockmann & Barnard, 1979), herring gulls face little competition, but corvids may be an exception. Tangren (1982) observed that northwestern crows would chase off glaucous-winged gulls (*Larus glaucescens*) attempting to steal food, suggesting potentially similar dynamics could be present between crows and herring gulls in Britain. Herring gulls were considered ecologically equivalent to northwestern crows by Tangren, being smaller than glaucous-winged gulls. Given that carrion crows are larger than northwestern crows and herring gulls are smaller than glaucous-winged gulls, it is reasonable to suggest that carrion crows would be more than capable of discouraging herring gulls from a foraging resource. Where the negative seagrass association was significant in MHW, higher numbers of crows were also observed; competition with crows, rather than seagrass itself, may explain this pattern. While corvids are restricted by tides, herring gulls are not, leading to temporal differences in habitat use (Tangren, 1982). There was no apparent association with seagrass in CH, where corvid densities were comparatively low.

Further study is needed to determine if the presence of crows deters herring gulls from intertidal foraging resources, and whether the same negative association with seagrass appears at high tide when crows cannot use the habitat. At present, there is minimal evidence that seagrass directly influences herring gull foraging behaviour.

Oystercatcher only exhibited positive associations with seagrass in MHW, showing little evidence of an overall preference towards seagrass in CH. This discrepancy was also observed in redshank, which showed contrasting responses to seagrass in each region, a positive association in MHW and a negative association in CH. Both these species only exhibited positive associations with seagrass habitats in the region containing perennial type seagrass which had retained its biomass over winter. As such, living seagrass biomass was likely supporting greater densities than unvegetated sediment and areas of annual seagrass after it had died-off. Horn et al., 2020 also observed oystercatcher foraging more frequently on seagrass habitats in the Wadden Sea, supporting these findings. As redshank forage prey from surface sediment (Norazlimi & Ramli, 2015), the epi- and infaunal invertebrate communities supported by dense seagrass meadows (Attrill et al. 2000; Jackson et al. 2006; Smale et al., 2019) may explain the positive association with perennial type seagrass but not where seagrass biomass is absent. It should be noted that due to their high site fidelity (Burton & Armitage, 2005) and territorial foraging behaviour (Whitfield, 2003), movement of individuals would have been minimal. This makes within-site comparisons of foraging densities more insightful than between sites.

Fish density within UK *Z. marina* habitats is variable and area specific knowledge is incomplete but, where quantified, fish density is 4.6 times higher than in nearby sand habitats (Bertelli & Unsworth 2014; Furness & Unsworth 2020; Staveley et al. 2020). As such, seagrass should provide a better foraging resource for little egret. However, there was no evidence of a positive association with perennial seagrass in MHW where leaf matter remained. In contrast, where seagrass leaf matter was no longer present in CH there was a positive association. This is evidence that while seagrass likely influences little egret foraging habits, the precise relationship remains unclear. It may be that an unmeasured environmental variable, such as disturbance or surrounding habitats, would provide better explanation for the densities observed.

No response to seagrass

Black-headed gulls demonstrate dietary and foraging plasticity (Banks et al., 2009; van der Zee et al., 2012) which renders them less constricted by environmental conditions and habitat types. Lesser black-backed gulls predominantly forage at sea, favouring fish and crustaceans (Kubetzki and Garthe, 2003), also feeding at farms and landfills (Banks et al., 2009). Intertidal areas are not a preferred foraging habitat, and therefore any individuals observed during this study likely used these areas as supplementary feeding while roosting. Great black-backed gulls (*Larus marinus*) primarily forage along coastal areas and often travel offshore in winter (Wells, 1994), which aligns with the low numbers recorded during this study. Declines in eastern regional populations (Banks et al., 2009) may account for the limited data from CH surveys. Similar to lesser black-backed gulls, their intertidal foraging appears secondary to roosting behaviours, indicating that foraging in intertidal zones likely does not significantly affect their foraging patterns.

In this study, curlew lacked evidence of any response to seagrass in either region and were seen feeding across all habitats. With longer legs and an extended bill, this large wader has greater flexibility in foraging than the smaller waders observed (Goss-Custard et al., 1977; Prater, 1981; Van Gils et al., 2020). It is able to forage in deeper water, less impacted by tidal changes. In winter, *H. diversicolor* burrows deeper into sediment, reducing accessibility for curlew (Zwarts & Esselink, 1989) resulting in wintering curlew relying more heavily on visual surface pecking and prey such as *Carcinus maenus* (Goss-Custard et al., 1977; Perez-Hurtado et al., 1997). They are known to respond positively to increased prey abundance (J.D. Goss-Custard et al., 1977; Yates et al., 1993) particularly larger polychaetes and crustaceans, (Goss-Custard et al., 1991). The association between seagrass and an abundance of crustaceans and polychaetes is well documented (Bertelli and Unsworth 2014; McCloskey & Unsworth 2015), however dense *H. diversicolor* populations are noted to limit the colonisation of *Z. noltii* (Hughes et al., 2000) resulting in two stable states on upper mudflats; one dominated by plants and another dominated by infauna which prevents plant colonisation. These infaunal dominated sites can exhibit functional diversity and redundancy as high as in sites with seagrass, though with decreased abundance and species richness (Kindeberg et al., 2022). With abundant infauna and crustaceans in seagrass dominated habitat and *H. diversicolor* in infaunal dominated habitat, curlew can forage effectively across both habitats with minimal limitation. The lack of evidence observed in this study towards any association with seagrass aligns with this dietary flexibility.

Recurring trends

Within the species that showed little evidence of an association with seagrass in CH, crow, curlew and common gull showed significantly reduced density on sites containing patchy seagrass. The cause of this pattern is unclear because these species have widely different foraging behaviour and diet, and therefore a common pattern between them is unlikely to be related to food provision. The lack of seagrass matter due to annual changes in CH further suggest that this trend is unrelated to seagrass condition.

Even where seagrass is present, fragmentation does not cause significantly lower invertebrate abundance (Yarnell et al., 2021), negating the argument that fragmentation would reduce prey for invertivorous species like curlew. Both crows and common gulls have an especially broad dietary niche, regularly feeding from both intertidal and terrestrial habitats (Kubetzki & Garthe, 2003; Madge, 2020). They share this flexible diet with other *Larus* gull species (Prater, 1981; Kubetzki and Garthe, 2003) which similarly showed little evidence of any effect of seagrass preference overall, however the black headed gull and herring gull did not present the same negative effect of patchy sites - further reducing the likelihood that patchy seagrass negatively impacted foraging opportunities for this species.

Little egret in MHW additionally showed a negative association with patchy sites, though this was the only species to do so in a region where perennial seagrass matter still remained. Like with invertebrates, where fragmentation of seagrass is not influential to abundance and diversity (Yarnell et al., 2021), fish also have unclear relationships with fragmentation of seagrass (Jackson et al., 2006). Patchy sites should still support more fish than unvegetated sites (Staveley et al. 2016; Zarco-Perello & Enríquez 2019), so other factors outside of this study may be of greater influence.

Effect of seagrass in relation to tidal state

Shelduck exhibited a negative interaction between seagrass and tide within CH on patchy seagrass sites, with reduced densities on seagrass areas during a flood tidal state. Shelduck most often use a scything motion to forage, moving their bill through the first two centimetres of sediment (Viain et al., 2011). When the sediment dries as time exposure to air increases, shelduck begin digging for prey more frequently. The mats of seagrass leaves and the buried rhizome networks likely make it more challenging for shelduck to scythe the top layers of sediment or dig once it begins to dry. As this interaction was only observed in shelduck in CH where the annual seagrass shoots had already been grazed away, the rhizomes are more likely to be the cause of any difficulties. It is possible that where perennial seagrass retains leaf biomass over winter such as in MHW, the increased invertebrate abundance and diversity (Attrill et al. 2000; Jackson et al. 2006; Smale et al., 2019) counteract the difficulties that the rhizome networks create. With little literature to draw upon, these are only inferences; further research is required to substantiate whether this relationship with seagrass is repeatedly detectable.

For redshank, oystercatcher, and dunlin, seagrass habitats appeared to moderate the influence of tidal fluctuations on bird densities. Typically, tidal state restricts foraging opportunities for wading birds, as sediment desiccation during exposure prompts prey species to burrow deeper (Norazlimi and Ramli, 2015). Additionally, the availability of foraging habitat declines with increasing time before and after low tide due to tidal immersion (Horn et al., 2020). Redshank do not only congregate in the best feeding sites but rather maximise their time and efficiency of foraging on estuarine habitat during winter months to try and meet their energetic needs (Goss-Custard, 1969; Goss-Custard, 1970). The maximising of winter foraging time may have lead to the appearance of this effect as there is potential for seagrass to extend the period of time prey is available to these species.

That the moderating effect was evidenced in both the perennial and annual seagrass populations suggests that the effect of the interaction between seagrass and tidal state on foraging waders is more likely driven by the underground structure of seagrass or its influence on sediment height (Potouroglou et al., 2017), rather than by its above-ground complexity. By elevating the sediment, areas of intertidal seagrass remain exposed or under shallower water depth for longer than those without. While the effect of seagrass on intertidal sediment desiccation is yet to be investigated however it is possible that intertidal seagrass biomass, especially the network of rhizomes, would slow desiccation by holding moisture. This is a speculative hypothesis and would need further investigation to explore the validity of this claim. Evidence from this study does suggest that when seagrass is present in an area, even without shoot biomass, some wading birds may be less affected by the impacts of tidal changes. Both elevated sediment height and reduced desiccation would increase the availability of prey within seagrass meadows. This may help reduce sensitivity to ecological change by allowing these species to extend their foraging periods throughout winter.

What does this mean for conservation?

The CMS (2023) highlights the critical importance of seagrass ecosystems for global migratory species such as dugongs (*Dugong dugon***)**, green sea turtles (*Chelonia mydas*), , sharks, and other marine species; additionally, they encourage research on the role of seagrass ecosystems in supporting migratory species beyond those explicitly listed. Thus, avian species should not be overlooked when compiling an inventory of migratory species that utilise seagrass meadows.

Regardless of individual species patterns of seagrass use, this study provides evidence that seagrass habitats are important resources for a range of overwintering avian species within British estuaries. It presents a foundation for a national inventory of migratory birds that use seagrass meadows with 18 CMS-listed species (CMS, 2015) observed foraging in intertidal seagrass during winter surveys. Classifying the foraging habitats of overwintering avifauna is essential to inform management actions for avian conservation efforts. Likewise, recognising the role of intertidal seagrass in supporting these species assists in informing and promoting seagrass conservation and restoration.

Conclusions

The present study highlights the role of intertidal seagrass as a foraging resource for a variety of wintering avian species, including several migratory species listed by the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 2015). While there is a lack of clarity in defining the exact role of seagrass in supporting individual wintering bird species, I provide evidence that these habitats are widely foraged by species with different diets and behaviours. . Additionally, the varied density trends seen across the different regions suggest that local factors such as regional life history strategies may influence the functionality of seagrass for birds. Further evidence suggests that seagrass acts to moderate the impact of tidal cycles on foraging densities in redshank, oystercatchers, and dunlin indicating a potential ecological function of these habitats. Species with broad dietary niches and high foraging plasticity were not strongly associated with either habitat type, with the exception of corvids, for which seagrass habitats appeared to offer elevated foraging platforms that facilitated access to intertidal prey while minimizing exposure to water. The limited availability of existing literature on avian usage of intertidal seagrass makes it difficult to draw any conclusions regarding preferences for seagrass habitats versus unvegetated areas. As such, further research is recommended to explore whether seagrass provides benefits to the bird species that forage within it. Nonetheless, it is clear that intertidal seagrass habitats are utilised by many migratory birds, underscoring the importance of continuing to build on this knowledge in line with CMS guidelines.

Appendix A: Study Site Regional Information

Chichester Harbour

CH is an estuary in the south-east of England covering approximately 31 square kilometres (km). The Harbour consists of four main channels with much of the estuary being intertidal; this can be summarised as approximately 2601 hectares (ha) intertidal, 635 ha subtidal, and 142 ha nontidal. It is a tidal basin with a tidal range of 2.7m (neap) to 4.9m (spring), sheltered by spits either side of the mouth and the Isle of Wight to the south, both of which limit the power of waves forming within the basin. The harbour is popular for recreational watersports, especially during the summer months, which increases risk of disturbance to habitats and wildlife within. It is connected to the adjacent Langstone Harbour by a narrow channel in the north-west of the estuary, and these two estuaries together form Chichester and Langstone Harbours SPA (Site Code UK9011011) and Chichester and Langstone Harbours Ramsar (Site Code 7UK032). The sheltered muddy and sandy sediments within CH support extensive areas of seagrass. The area is internationally important for breeding, passage, and overwintering species of birds, regularly supporting at least 20,000 waterfowl. The species included as qualifying features of the SPA are breeding: little tern (*Sterna albifrons*) and sandwich tern (*Sterna sandvicensis*); on passage: little egret (*Egretta garzetta*); overwintering bar-tailed godwit (*Limosa lapponica*) and little egret (*Egretta garzetta*); and the migratory species of: ringed plover (*Charadrius hiaticula*), black-tailed godwit (*Limosa limosa islandica*), dark-bellied brent goose (*Branta bernicla bernicla*), dunlin (*Calidris alpina alpine*), grey plover (*Pluvialis squatarola*), redshank (*Tringa tetanus*) and ringed plover (*Charadrius hiaticula*).

Milford Haven Waterway

Milford Haven Waterway is a large ria in south-west Pembrokeshire, existing within the Pembrokeshire Marine Special Area of Conservation (SAC) (Site Code UK0013116). The smaller estuaries that open into the broader MHW channel are largely overlapping with the Milford Haven Site of Special Scientific Interest (SSSI). These smaller estuaries make up the BTO WeBS site Cleddau Estuary, with only minor discrepancies from the SSSI; Castle Pill is included in the Low Tide Count but not the SSSI, and both the upper reaches of Eastern Cleddau and Cresswell rivers, and non-estuarine stretches of shoreline are in the SSSI but not the Low Tide Count. For this study, the boundaries used were that of the Cleddau Estuary BTO WeBS site, which covers approximately 18 km2, consisting 1208 ha intertidal, 505 ha subtidal, 110 ha nontidal. MHW itself has many smaller tributaries, and forms a naturally deep, wide channel that opens out to the Celtic Sea. Its eastern upper reaches are mostly used for recreational purposes but the deep western channel is used heavily as a port for large industrial ships and oil tankers of up to 250,000 tonnes. The Port of Milford is the UK's third largest port, supporting 29% of seaborne trade in oil and gas. The southern coast of the estuary is home to a large oil refinery and power station. As such, MHW has been subjected to numerous oil spills and high levels of contaminants affecting the region's fauna (Little et al., 2016). Dredging of the channel in 2006 led to elevated levels of sediment polycyclic aromatic hydrocarbons (PAHs) which coincided with notably reduced counts of shelduck in the 2006/7 winter and 2007 breeding season. Further dredging in 2012 coincided with low counts of wigeon in late 2012. The Pembrokeshire Marine SAC was designated in part due to the Annex 1 habitat large shallow inlets and bays which includes the extensive *Zostera spp.* beds and intertidal sand and mud flats. The SSSI was designated in part due to nationally important numbers of overwintering waterfowl and waders. Species of special interest include the little grebe (*Tachybaptus ruficollis)*, shelduck (*Tadorna tadorna)*, wigeon (*Anas penelope)*, teal (*Anas crecca)*, dunlin (*Calidris alpina)*, and curlew (*Numenius arquata)*.

Appendix B: WeBS Data

Data were provided by WeBS, a Partnership jointly funded by the British Trust for Ornithology, Royal Society for the Protection of Birds and Joint Nature Conservation Committee, in association with The Wildfowl & Wetlands Trust, with fieldwork conducted by volunteers. Although WeBS data are presented within this report, in some cases the figures may not have been fully checked and validated. Therefore, for any detailed analyses of WeBS data, enquiries should be directed to the WeBS team at the British Trust for Ornithology, The Nunnery, Thetford, IP24 2PU (webs@bto.org).

Appendix C: Effects of Seagrass on Avian Densities, Statistics

Effects of seagrass (SG) on avian densities compared between sites containing continuous seagrass (Cont. SG) and patchy seagrass (Patchy SG), across all sites (Overall On SG), and within sites containing patchy seagrass (Within Patchy Sites). Values were calculated in R4.3.2. (R Core Team, 2023). Significance is indicated by asterisks (* indicates a moderate level of evidence, ** indicates strong evidence, *** indicates very strong evidence).

Species		Chichester Harbour				Milford Haven Waterway			
		Cont. SG	Patchy SG	Overall On SG	Within Patchy Sites	Cont. SG	Patchy SG	Overall On SG	Within Patchy Sites
black-headed gull	p	0.44	0.34	0.326	0.116	1	1	0.978	0.630
Chroicocephalus ridibundus	Est.	-1.624	-2.160	0.925	0.775	45.5	45	-0.038	-1.61
common gull	p	0.1434	**0.0064 ****	0.5988	-	0.4334	0.9963	0.96	0.15
Larus canus	Est.	-1.2	**-2.375**	-0.397	-	1.251	-0.007	-0.048	0.89
great black-backed gull	p	-	-	-	-	-	-	-	0.34
Larus marinus	Est.	-	-	-	-	-	-	-	1.1
herring gull	p	0.5480	0.9997	0.68	-	0.7151	0.3536	**0.004 ****	**0.0076 ****
Larus argentatus	Est.	-0.944	-44.1	-0.703	-	-0.344	-0.877	**-0.732**	**-1.763**
lesser black-backed gull	p	-	-	-	-	0.2111	0.6014	0.591	-
Larus fuscus	Est.	-	-	-	-	2.039	-0.951	0.588	-
curlew	p	0.1344	**<0.001 *****	0.9252	0.45	0.3715	0.5521	0.22	0.3467
Numenius arquata	Est.	-0.548	**-1.609**	-0.027	0.305	-0.878	-0.567	-0.529	-0.408
dunlin	p	0.7782	0.089	**<0.001 *****	**<0.001 *****	0.97	1	0.95	-
Calidris alpina	Est.	-0.369	-2.494	**-0.952**	**-0.975**	14.34	-5.61	9.97	-
grey plover	p	**0.042 ***	**0.016 ***	0.0662	**<0.001 *****	0.584	1	0.593	-
Pluvialis squatarola	Est.	**-1.375**	**-1.659**	0.823	**1.241**	0.529	-195	0.556	-
knot	p	0.8811	0.8156	0.58	0.44	0.97	1	0.95	-
Calidris canutus	Est.	0.522	1.658	1.14	0.238	13.897	0.629	11.3	-
oystercatcher	p	0.328	0.057	0.525	0.5841	0.60	0.56	**<0.001 *****	0.15
Haematopus ostralegus	Est.	-1.507	-3.332	0.37	-0.221	1.62	1.81	**1.461**	0.728
redshank	p	0.3740	**0.0122 ***	**0.0149 ***	**<0.001 *****	**0.0049 ****	**0.0033 ****	**0.0025 ****	0.549
Tringa totanus	Est.	-0.471	**-1.442**	**-0.937**	**-1.459**	**5.195**	**5.538**	**2.072**	0.241

crow	p	0.892	**0.046 ***	0.87	-	0.1740	**0.0438 ***	**0.018 ***	**0.0408 ***
Corvus corone	Est.	-0.114	**-2.127**	-0.133	-	1.55	**2.249**	**1.021**	**1.003**
jackdaw	p	-	-	-	-	1	1	**0.0213 ***	**0.0103***
Corvus monedula	Est.	-	-	-	-	14.0	14.6	**4.18**	**3.65**
little egret	p	0.983	0.984	**0.0015 ****	0.056	0.053	**<0.001 *****	0.91	0.7634
Egretta garzetta	Est.	15.897	15.269	**2.399**	1.513	-0.502	**-1.643**	-0.043	-0.182
shelduck	p	0.0522	0.3231	0.7187	0.6671	0.072	0.165	0.1001	0.28
Tadorna tadorna	Est.	3.48	1.92	-0.242	0.13	-3.93	-2.77	-0.866	0.261

Appendix D: Environmental Variables in Species Statistical Models

Effects of various environmental variables on avian densities compared across all sites and within sites containing patchy seagrass. Values were calculated in R4.3.2. (R Core Team, 2023). Significance is indicated by asterisks (***** indicates a moderate level of evidence, ****** indicates strong evidence, ******* indicates very strong evidence).

Species	Chichester Harbour				Milford Haven Waterway			
	All sites		Within Patchy Sites		All sites		Within Patchy Sites	
	Est.	p	Est	p	Est.	p	Est	p
black-headed gull								
Variables:								
Temperature	**-0.366**	**0.019***	-	-	-	-	-	-
Hour	-	-	-0.136	0.089	-	-	-	-
common gull								
Variables:								
Hour	**0.180**	**0.007****	-	-	-	-	-	-
great black-backed gull								
Variables:	-	-	-	-	-	-	-	-
herring gull								
Variables:								
Temperature	-	-	-	-	-	-	**0.665**	**0.004****
Wind	-	-	-	-	**0.798**	**<0.001*****	-	-
Tide (flood - F)	-	-	-	-	**-0.932**	**0.006****	**-1.356**	**0.027***
Interactions:								
Tide (F): SG (Y)	-	-	-	-	-0.699	0.073	-	-
lesser black-backed gull								
Variables:								
Cloud	-	-	-	-	1.018	0.052	-	-
curlew								
Variables:								
Wind	**-0.249**	**0.003****	-	-	-	-	-	-
dunlin								
Variables:								
Cloud	-	-	**1.423**	**<0.001*****	-	-	-	-
Hour	-	-	0.115	0.105	-	-	-	-
Tide (F)	**0.947**	**<0.001*****	-	-	-	-	-	-
Interactions:								
Tide (F): SG (Y)	**-1.322**	**0.012***	-	-	-	-	-	-
grey plover								
Variables:								
Cloud	-	-	**0.81**	**0.021***	-	-	-	-
Wind	0.29	0.092	0.79	0.067	-	-	-	-
knot								
Variables:	-	-	-	-	-	-	-	-
oystercatcher								

Variables:								
Wind	-	-	**1.378**	**0.001****	-	-	-	-
Tide (F)	-	-	**-3.113**	**0.012***	**0.438**	**0.032***	-	-
Interactions:								
Tide (F): SG (Y)	-	-	**4.515**	**<0.001*****	**-0.757**	**0.015***	-	-
redshank								
Variables:								
Temperature	-	-	-	-	0.034	0.723	**-0.432-**	**0.002****
Tide (F)	**-0.913**	**0.001****	**-0.67**	**0.044***	-	-	1.697	0.125
Interactions:							**1.899**	
Tide (F): SG (Y)	0.791	0.097	**1.459**	**0.004****	-	-	-	**0.025***
Temperature:SG (Y)	-	-	-	-	**-0.239**	**0.007****		-
crow								
Variables:								
Hour	-	-	-	-	-	-	0.086	0.176
Tide (F)	-	-	-	-	1.105	0.221	-	-
Interactions:								
Tide (F): SG (Continuous)	-	-	-	-	-0.635	0.491	-	-
Tide (F): SG (Patchy)	-	-	-	-	-1.483	0.118	-	-
jackdaw								
Variables:								
Tide (F)	-	-	-	-	-	-	**3.59**	**0.007****
little egret								
Variables:								
Wind	-0.455	0.098	-	-	0.039	0.772	-0.287-	0.203
Tide (F)	-	-	-	-	-	-	1.65	0.132
Interactions:								
Tide (F): SG (Y)	-	-	-	-	-	-	0.875	0.522
shelduck								
Variables:								
Tide (F)	-	-	0.217	-3.462	-	-	-	-
Interactions:								
Tide (F): SG (Y)	-	-	**0.724**	**0.001****	-	-	-	-

Appendix E: Random Effects

Amount of variance attributed to random effects of date and site on avian densities compared across all sites and within sites containing patchy seagrass. Values were calculated in R4.3.2.

Species	Chichester Harbour				Milford Haven Waterway			
	All sites		Within Patchy Sites		All sites		Within Patchy Sites	
	Variance	Std Dev	Variance	Std Dev	Variance	Std Dev	Variance	Std Dev
black-headed gull								
Date	2.058	1.435	0.069	0.263	<0.001	0.014	69.19	8.316
Site	7.631	2.762	18.91	4.349	<0.001	0.012	4.515	2.125
common gull								
Date	<0.001	0.002	-	-	0.863	0.929	<0.001	<0.001
Site	1.307	1.143	-	-	2.083	1.44	<0.001	0.003
great black-backed gull								
Date	-	-	-	-	-	-	0.761	0.872
Site	-	-	-	-	-	-	<0.001	0.003
herring gull								
Date	2.461	1.569	-	-	2.595	1.611	<0.001	0.014
Site	2.953	1.718	-	-	0.878	0.937	0.569	0.754
lesser black-backed gull								
Date	-	-	-	-	0.005	0.0698	-	-
Site	-	-	-	-	<0.001	<0.001	-	-
curlew								
Date	<0.001	<0.001	<0.001	0.007	<0.001	0.006	<0.001	0.002
Site	0.538	0.734	<0.001	0.002	0.8431	0.918	1.079	1.039
dunlin								
Date	0.627	0.792	0.176	0.419	1.504	1.226	-	-
Site	2.963	1.721	3.679	1.918	6.68	2.585	-	-
grey plover								
Date	0.76	0.871	0.320	0.566	<0.001	<0.001	-	-
Site	1.736	1.318	0.185	0.430	<0.001	<0.001	-	-
knot								
Date	123	11.9	1.626	1.275	0.002	0.041	-	-
Site	44.09	6.64	1.631	1.277	8.804	2.967	-	-
oystercatcher								
Date	<0.001	0.004	<0.001	<0.001	0.255	0.505	<0.001	0.019
Site	5.624	2.371	<0.001	<0.001	15.28	3.909	15.18	3.896
redshank								
Date	<0.001	0.003	0.044	0.209	0.763	0.874	1.548	1.244
Site	0.569	0.754	0.342	0.585	1.776	1.333	2.2	1.483
crow								
Date	<0.001	0.006	-	-	0.364	0.603	<0.001	0.002
Site	1.742	1.32--	-	-	0.759	0.871	0.757	0.87
jackdaw								
Date	-	-	-	-	123.1	11.09	<0.001	0.008

Site	-	-	-	-	36.82	6.068	89.68	9.47
little egret								
Date	<0.001	0.011	<0.001	0.012	0.171	0.413	<0.001	0.002
Site	0.011	0.105	<0.001	0.004	<0.001	<0.001	0.262	0.512
shelduck								
Date	0.494	0.703	0.645	0.805	0.137	0.37	0.230	0.48
Site	5.213	2.283	1.007	1.003	5.565	2.359	4.686	2.165

Appendix F: R Statistical Analysis Script

The R script used for statistical analyses in this study is available upon request. Due to its length, it has not been included in this document.

Appendix G: Statement of Expenditure

MRes Biosciences - Statement of Expenditure

Student Name: Emma Butterworth

Student Number: 957069

Project Title: Influence of intertidal seagrass (*Zostera spp.*) on foraging locations of wintering birds in two British estuaries

Category	Item	Description	Cost*
Fieldwork	Accommodation	28 days of accommodation in Chichester Harbour	£600
Travel	Fuel	Petrol for driving to and from survey sites on fieldwork.	£447.50
Total:			£1047.50

*Including VAT and delivery where applicable

I hereby certify that the above information is true and correct to the best of my knowledge.

[redacted] [redacted]

Signature (Supervisor) Signature (Student)

Appendix H: Statement of Contributions

Contributor Role	Persons Involved
Conceptualisation	EB, RU
Data Curation	EB
Formal Analysis	EB
Funding	n/a
Investigation	EB
Methodology	EB, RU, CB
Project Admin	EB
Resources	EB, RU
Software	EB, RU
Supervision	RU
Validation	EB, RU
Visualisation	EB, RU
Writing- Original Draft Preparation	EB
Writing- Review & Editing	EB, RU

Appendix I: Copy of Ethics Approval

Swansea University
Prifysgol Abertawe

Approval Date: 02/02/2024

Research Ethics Approval Number: 2 2024 9032 7930

Thank you for completing a research ethics application for ethical approval and submitting the required documentation via the online platform.

Project Title	The role of seagrass meadows in supporting marine and coastal birds
Applicant name	MISS EMMA BUTTERWORTH
Submitted by	MISS EMMA BUTTERWORTH /
Full application form link	https://swansea.forms.ethicalreviewmanager.com/Project/Index/11019

The Science and Engineering ethics committee has approved the ethics application, subject to the conditions outlined below:

Approval conditions

1. The approval is based on the information given within the application and the work will be conducted in line with this. It is the responsibility of the applicant to ensure all relevant external and internal regulations, policies, and legislations are met.
2. This project may be subject to periodic review by the committee. The approval may be suspended or revoked at any time if there has been a breach of conditions.
3. Any substantial amendments to the approved proposal will be submitted to the ethics committee prior to implementing any such changes.

Specific conditions in respect of this application:

The application has been classified as Low Risk to the University.

No additional conditions.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees. It complies with the guidelines of UKRI and the concordat to support Research Integrity.

Science and Engineering Research and Ethics Chair

Swansea University.

If you have any queries regarding this notification, then please contact your research ethics administrator for the faculty.

- For Science and Engineering contact FSE-Ethics@swansea.ac.uk
- For Medicine, Health and Life Science contact FMHLS-Ethics@swansea.ac.uk
- For Humanities and Social Sciences contact FHSS-Ethics@swansea.ac.uk

Appendix J: Copy of H&S and Risk Assessments

V1.1 2023

Risk Assessment for Teaching and Research Activities*

Swansea University; FSE: Biosciences

Name ....Emma Butterworth.... **Signature** ..[redacted].. **date** 02/02/2024

Supervisor* ....Dr Richard Unsworth.... **Signature** ..[redacted]...... **date** 02/02/2024

Activity title ....MRes Biosciences.... **Base location (room no.)** ...

(* the supervisor for all HEFCW funded academic and non-academic staff is the HOD or their nominee)

University Activity Serial # (enter Employee No. or Student No.). ....[redacted]

Start date of activity (cannot predate signature dates) 01/02/2024

End date of activity (or 'on going') ....On going

Level of worker (choose from the list below)...M.Res.

UG, MSc, M.Res. M.Phil/PhD, RA/Postdoc, technician, administration, academic staff, visitor, other (state)

Ethics approval number ......2 2024 9032 7930.........

Approval obtained for Biological Hazards and/or GMO Safety Assessment by SU? not applicable

Is your project: (circle the appropriate choice A-D)

A. Laboratory-based only (i.e. you **never** work in the field)
B. Field AND laboratory-based
C. Field-only based (i.e. you do not have an allocated laboratory space and **never** work in a laboratory)
D. Desk based (i.e. no field or laboratory base. i.e. you are only allocated office space [if you are a PhD or research member of staff])

For **category A** complete this Risk Assessment template and associated laboratory protocols, and a Training Record form.
For **category B** complete this Risk Assessment template and associated laboratory protocols, a Training Record form, AND either complete the FSE on-line Field Risk Assessment (**for UG, MSc**) or the relevant University-template form (i.e. Red Form- Off Campus Activities & Risk Assessment Form) (**for MRes, PhD, all staff, visitors**)
For **category C** complete this Risk Assessment template (but not the protocol sheets) and the relevant on-line FSE field risk assessment or University-template forms (see B above for details) and complete a Training Record
For **category D** complete the Training Record template **and** this front page.

***N.B. All staff, visitors and students must have risk assessments for their studies in the University. No work can commence until these have been completed. They must be always available for inspection. Some of these may be paper-based but others can be stored electronically.**

1

Off Campus Activities & Fieldwork Risk Assessment (Moderate/ High) - Red Form

This form should be completed for moderate/ high risk fieldwork activities

- For low-risk activities in the United Kingdom (e.g., attending conferences/ business meetings/ museums or other low risk-controlled sites) use the **green form**.
- If the fieldwork is arranged jointly between one or more Faculties/ PSUs, a shared risk assessment and authorisation should be undertaken.
- If travelling as a group undertaking the same activity, only one risk assessment form needs to be completed along with the **Participant Declaration and Information Form.**

g

General Information This section MUST be completed by the Fieldwork Risk Assessor (leader)

Fieldwork Risk Assessor				
Name:	Emma Butterworth		Please Specify	Staff ☐ PG Student X UG Student ☐ Other ☐
Staff/ Student Number:	[redacted]			
Email:	[redacted]		Tel:	[redacted]
Faculty/ PSU:	Science and Engineering		School:	Biosciences
Risk Assessment Date:	24/01/2024			
Expected Departure Date:	03/02/2024		Expected Return Date:	29/02/2024
Number of persons taking part in this field trip:	Supervisors:		Participants:	1
Line Manager/ Supervisor of Fieldwork Risk Assessor				
Name:	Dr Richard Unsworth		Department:	Biosciences
Email:	[redacted]		Tel:	[redacted]

Fieldwork Information	
Fieldwork/ Research Title:	
Type of fieldwork: Please include a brief description and goal of the type of work to be performed e.g., collection of samples, observation of animals/ environment, interviews with human subjects, etc.	Observation of birds in the field
Please provide details of the activities to be undertaken e.g., interviewing, quadrating, snorkelling, diving, rock climbing	Vantage point survey. Researcher will be set up at a location that overlooks the area of interest. Point count survey will be conducted using telescope and/or binoculars for 30 minutes each time.
Level of Risk of Fieldwork Please see risk categories in guidance document to determine the risk levels. This will determine the level of authorisation.	Moderate X High ☐

Additional forms included (see Staff H&S Pages or PG H&S Pages)	
Participant Declaration and Information Form (group travel only)	☐
International Travel Risk Assessment Form (where applicable)	☐

Insurance

Insurance: Please provide details of insurance cover. See guidance for further information.	Swansea University Cover Staff - Insurance webpage Students - Insurance webpage University travel cover for overnight accomodation away from normal place fo residence.

Email Insurance@Swansea.ac.uk	Additional insurance required: Yes ☐ No X If yes, please give details:

Location & Communication for Fieldwork

Location of Fieldwork(s): (This may be general location and NGR/GPS/what three words coordinates)	Chichester Harbour, ///wanting.wrenching.area	
Nearest Town/ City: (Name, distance from site)	Chichester, approx 9km from sites	
Mobile Phone Coverage https://www.gsma.com/coverage/	**Primary Number:**	[redacted]
	Coverage:	Good X Sparse ☐ None ☐
	If none, nearest location with coverage:	
Local contact details (if applicable)	Name:	
	Tel:	
	Email:	
Satellite phone/ device You must know how to contact emergency services via Sat Phone. 999/ 911 typically does not work.	Device Carried:	Yes ☐ No X
	Number:	
Radio	Radio Carried:	Yes ☐ No X
	Radio Channel:	
	Who can be contacted using this radio?	

Other: List any other communication devices/ methods that may be used**.**			
Nearby Facilities: What facilities are available at or near the site: restrooms, water, public phone, shop? If there are no facilities, where are the nearest welfare services/ what provisions will you have in place?	**No facilities at site.** **Nearest shops, water and public toilets available in West Wittering, Itchenor, Bosham, and Emsworth.**		
Down Time (see guidance for definitions): Are side trips planned or allowed during free time? If yes, please describe the activities. Are there restrictions, specific rules, or expected code of conduct? Have these activities been risk assessed? Is insurance in place for these activities?	**No side trips planned except for grocery shopping.**		
Complete the shaded section below for: Fieldwork in the United Kingdom ONLY **This section is already included in the International Travel Forms**			
Swansea University Contact	Name:	**Dr Richard Unsworth**	
	Phone number(s):	[redacted]	
	Email:	[redacted]	
	Frequency of check ins: e.g., Daily, at end of workday, etc. (State GMT or	**Please specify.** **Twice weekly**	

	other)	
	Detail actions to follow if the traveller fails to make contact:	
Accommodation details If not known, please complete prior to travelling and share with your Swansea University contact.	**Cobnor Activities Centre, Cobnor Point, Chidham, Chichester, PO18 8TE**	
Emergency Contacts	Swansea University Security:	[redacted]
	SafeZone App:	Downloaded Yes x No ☐
	Travel Planet Emergency Number:	[redacted]
Personal Emergency Contact details (if applicable) Only complete if sole fieldworker, group leader. Group information will be collected on participant information form.	Phone:	[redacted]
	Email:	[redacted]

Fieldwork Risk Assessment

This risk assessment relates to the activities you will be carrying out during your fieldwork in the countries you are visiting. See guidance for examples of things to consider in this section.

What are the hazards?	Who may be harmed? How may they be harmed?	Controls/ Mitigation	By Whom	By When
Road traffic accidents	Research, field assistants, other road users Physical injury	• Ensure the mode of transport has the appropriate insurances, licences • Check the mode of transport is road worthy prior to use • Ensure driver is alert and in fit state to drive • Check road and weather conditions	All parties	Prior to and during fieldwork travel
Slippery and/or uneven surfaces	Researcher and field assistants slips, trips and falls, causing cuts, bruises and/or broken bones	o Wear strong and sensible footwear. o Take care, especially on wet surfaces and loose screes. o Be aware of other potential trip hazards. o Adjust or abandon route if necessary.	All parties	During fieldwork activities
Weather (wet and cold)	Researcher and field assistants Hypothermia and illness	o Wear warm and waterproof clothing. o Carry spare clothing. o Carry survival bag/blanket. o Carry food and warm drink.	All parties	During fieldwork activities
Hazardous plants	Researcher and field assistants Scratches, stings, rashes, and/or thorns	Look out for brambles, gorse, rose and other thorny plants. Be aware of, and look out for hazardous/poisonous plants such as giant hogweed.	All parties	During fieldwork activities
Infection	Researcher and field assistants	o Clean skin wounds carefully with clean water and/or antiseptic wipes/cream.	All parties	During fieldwork activities

		o Carry simple first-aid kit.		
Fences and stiles	Researcher and field assistants Injury from tripping. Minor cuts/bruises from sharp surfaces. Shock from electric fences.	o Take care at all times. o Look out for sharp surfaces, barbed wire and electric fences. Avoid where possible.	All parties	During fieldwork activities
Tidal environment (mudflat/saltmarsh)	Researcher and field assistants Entrapment in mud, isolation by rising water, fast flowing water in gullies, hypothermia following accidental exposure to water, pollution, litter and debris leading to cuts and physical injuries.	o Plan and know the tidal times and tidal range for the day(s) of sampling. o Do not enter the tidal environment. It is not necessary for this research activity	All parties	During fieldwork activities
Public interaction	Researcher and field assistants Aggression, physical injury, assault, mental trauma,	Be polite and try to de-escalate if possible. Assess risk and apply appropriate lone working procedures. Leave site immediately if any danger suspected. Report suspicious behaviour	All parties	During fieldwork activities
Coronavirus	Researcher and field assistants People can catch COVID19 from others who have the virus. These people may be symptomatic or asymptomatic. Worst case, this may be fatal, illness of varying degrees. Refer to NHS website for symptoms	Comply with Country / Local coronavirus restrictions. Wales: https://gov.wales/covid-19-alert-levels • Do not attend fieldwork if you have coronavirus symptoms (New and continuous cough / high temperature / loss or change of taste or smell) • Do not attend fieldwork if someone in your household has coronavirus symptoms, or you have been told to	All parties	During fieldwork activities

		self-isolate by Test, Trace and Protect. • Check for updates: https://myuni.swansea.ac.uk/coronavirus-studentfaqs/ Hands / Face / Space / Fresh air • Wash hands frequently and always before eating / drinking. Use hand sanitizer or soap and water. Avoid touching your face with unwashed hands. • Cover your nose and mouth with a tissue or your elbow (not your hands) when you cough or sneeze.		
Using telescope/binoculars for long periods of time	Researcher and field assistants Eye strain	Take breaks between surveys. 20-20-20 rule where possible (look 20m away for 20 seconds every 20 minutes). Bring eye drops. Wear contact lenses where needed.	All parties	During fieldwork activities

Add additional boxes as required.

First aid requirements

Name	Contact number whilst in the field:	Qualification Tick the qualification held	Expiry Date	First Aid Kit Carried	Specialist equipment carried? *If yes, please give details*	
Emma Butterworth	[redacted]	☐ Fully Trained – First Aid at Work (3 days) x Emergency First Aid (1 day) ☐ Mountain (wilderness) First Aid Trained (2 day) ☐ Mental Health First Aid ☐ Other – *please specify*	05/2026	X Yes ☐ No	☐ Yes x No	
		☐ Fully Trained – First Aid at Work (3 days) ☐ Emergency First Aid (1 day) ☐ Mountain(wilderness) First Aid Trained (2 Day) ☐ Mental Health First Aid ☐ Other – *please specify*		☐ Yes ☐ No	☐ Yes ☐ No	

Add additional boxes as required.

Training and Competency Requirements

List here any specific training or qualifications that need to be achieved as part of this fieldwork. This will have been identified during risk assessment above.

Training	Required for (supervisors /participants/skipper or named individual etc)	Achieved		Training date if applicable
		Yes	No	
Example - Water safety	*Participants*	☐	☐	*22.02.22*
		☐	☐	
		☐	☐	
		☐	☐	

		☐	☐	

Add additional boxes as required.

Emergency Planning

Nearest Hospital(s) (to field working site) information: (Include name, distance from site, phone number, address, and postal code).	St Richards Hospital, Spitalfield Ln, Chichester PO19 6SE 9km from site 01243 788122
Emergency evacuation plan for site: Where abstraction may be difficult provide details of your evacuation plan and transportation options to the nearest hospital.	x if not applicable check the box.

Fieldwork Contingency Planning

If the fieldwork risk assessor becomes unable to lead the group for any reason e.g., becomes ill. What contingency do you have in place? i.e., will the students be able to continue/return to accommodation etc.?	Field assistants are unable to continue with research alone. Field assistants are independent adults and make their own transport/accomodation arrangements. Fieldwork activities will pause until researcher is well again.
If disruption to your fieldwork/ research has financial implications, what contingency do you have planned?	n/a

Equipment List

It is important the equipment list is completed in full. If something happens to the equipment in transit or it is stolen, then there is a record of equipment that can be provided to the University insurers.

Use this list to specify items of clothing/footwear, include also, sun creams, water bottles, mobile phones. Specify items of equipment that will be taken by fieldwork organiser such as life jackets first aid kits, GPS equipment, sample pots etc. Include items of communication equipment such as mobile phones, satellite phones, etc.

Item	Provided by participant	Provided by the University	Sourced locally
Zeiss SFL 10x40 binoculars	☐	☐	X
Vortex Diamondback HD 10x42 binoculars	X	☐	☐
Vortex Diamondback HD 20-60x85 Angled Spotting Scope	☐	☐	X
Manfrotto tripod	☐	☐	X
Slik Sprint Mini II tripod	X	☐	☐
Google Pixel 4a 5G	X	☐	☐
First Aid Kit	X	☐	☐
Chillys 500ml waterbottle	X	☐	☐
Camping chair	X	☐	☐
Helly Hansen waterproof sailing overtrousers	X	☐	☐
Gill OS2 Offshore jacket	X	☐	☐
Weatherwriter	X	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Add additional boxes as required.

Brief Itinerary

Date	Depart from	Depart time	Destination	Arrival time	Destination address or coordinates if applicable	Mode of travel and company name and flight no if applicable.	Activities and other information
01/02/ 2024	Home - Bridgend, [redacted]	06:00	Cobnor Activities Centre	10:00	[redacted]	Personal car	Base location for all surveys
29/02/ 2024	Cobnor Activities Centre	11:00	Home	15:00	[redacted]	Personal car	End of fieldwork

Date	Depart from	Depart time	Destination	Arrival time	Destination address or coordinates if applicable	Mode of travel and company name and flight no if applicable.	Activities and other information

Fieldwork Declarations

Field Risk Assessor(s):			
When signing this document, as the Field team leader you are confirming you: • Have personally, considered and understand the nature of the risks and the potential impact(s) and have considered steps to reduce and mitigate the risks associated with the fieldwork. • Have completed a suitable and sufficient fieldwork risk assessment. • Are fit to undertake the activity/ fieldwork, are not participating against medical advice and reasonable adjustments have been agreed where required. • All information and responses given are true and accurate to the best of my knowledge and belief. • If group leader, will ensure the information is shared with all participants, and will ensure the participant declaration and information form, and health declarations (where appropriate) are completed prior to travel. • All information and responses given are true and accurate to the best of my knowledge and belief.			
Name:	**Signature:**	**Faculty**	**Date:**
Emma Butterworth	[redacted]	Science and Engineering - Bioscience	31/01/2024

Once completed please send to the appropriate Faculty/ PSU teams for approval.

Fieldwork Authorisation

If the Fieldwork involves more than one Faculty/ PSU. Authorisation is required for all Faculty/ PSU's involved.

Approver		
By signing this document, I am confirming I have read the fieldwork risk assessment and I am satisfied that the proposed reasonable precautions are in place for the activity.		
Approval Moderate Risk:		
Line Manager/ Supervisor	**Name:**	Dr Richard Unsworth
	Signature:	[redacted]
	Faculty/PSU:	Science and Engineering - Bioscience
	Date:	31/01/2024
Head of department /Programme Director	**Name:**	

	Signature:	
	Faculty/PSU:	
	Date:	
High Risk:		
Head of School/ Director of PSU **OR** **Head of L&T/ Research**	**Name:**	
	Signature:	
	Faculty/PSU:	
	Date:	

Appendix 1 - Accommodation Safety

Field Course Leader Accommodation Safety Checklist		
If it has not been possible to verify the safety standards of accommodation through an approved travel agent, completing this form using the Fieldwork guidance document is one method you can use to help establish whether acceptable standards are in place. **Please complete the table below, *if required*, to confirm that an assessment has been completed:** ☐ This is not required		
	Checked	Comments
Fire Safety	☐	
Security	☐	
Building Safety Issues	☐	
Local Environment	☐	

☐ I have completed the review and consider that the accommodation is safe to use.

☐ I have considered and noted relevant points to include in the fire brief to fieldworkers on arrival.

X **This accommodation must be assessed on arrival.**

Appendix 2: Accident reporting **only to be used if online form is inaccessible.*

It is important that all accidents are investigated and, as soon as possible, a factual report, including any statements taken, should be forwarded to the University Safety Office. Whilst adverse events are usually reported online, it would be useful in some cases to have printed versions of the adverse event form to be completed when access to the university systems may not be possible or practicable. This procedure is important because serious accidents may have to be reported to the appropriate authorities.

All members of staff accompanying a fieldtrip must be aware of the emergency arrangements and the means of contacting the emergency services. It is also useful to be able to take photographs of the accident/incident and location(s) where appropriate and you can do so without compromising the health and safety of those involved.

The completed details of this form should be emailed to healthandsafety@swansea.ac.uk as soon as reasonably practicable. If this is not possible, please phone your University Contact and provide the details over the phone.

What is being reported?			
Date:		**Time:**	
Brief Details (What, where, when, who and emergency measures taken):			
Details of Injury (Person):			
What first aid was administered:			
Damage (Equipment/ Property/ Habitat):			
Witnesses (Name, Occupation and Tel No):			
Who was involved in the adverse event?			
Full Name:			
Age and DOB:			
Occupation/Course of study (if student):			
Job Title:			
University Faculty / PSU or Employer:			
Email:			
Tel:			
Full Name:			
Status:			
SU Staff/ Student number:			
Visitor:			
Other (specify):			
Has the adverse event resulted in an absence from fieldwork?		Yes ☐ No ☐	
If yes, for how long?			
Reported by:			
Name:			
Job Title:			
Tel:		Email:	
Date			

Off Campus Activities & Fieldwork Risk Assessment (Moderate/ High) - Red Form

This form should be completed for moderate/ high risk fieldwork activities

- For low-risk activities in the United Kingdom (e.g., attending conferences/ business meetings/ museums or other low risk-controlled sites) use the **green form**.
- If the fieldwork is arranged jointly between one or more Faculties/ PSUs, a shared risk assessment and authorisation should be undertaken.
- If travelling as a group undertaking the same activity, only one risk assessment form needs to be completed along with the **Participant Declaration and Information Form.**

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General Information This section MUST be completed by the Fieldwork Risk Assessor (leader)

Fieldwork Risk Assessor				
Name:	Emma Butterworth		Please Specify	Staff ☐ PG Student X UG Student ☐ Other ☐
Staff/ Student Number:	[redacted]			
Email:	[redacted]		Tel:	[redacted]
Faculty/ PSU:	Science and Engineering		School:	Biosciences
Risk Assessment Date:	26/02/2024			
Expected Departure Date:	01/03/2024		Expected Return Date:	29/03/2024
Number of persons taking part in this field trip:	Supervisors:		Participants:	4 (3 field assistants staggered timing, only one with leader at any time)
Line Manager/ Supervisor of Fieldwork Risk Assessor				
Name:	Dr Richard Unsworth		Department:	Biosciences
Email:	[redacted]		Tel:	[redacted]

Fieldwork Information	
Fieldwork/ Research Title:	

Type of fieldwork: Please include a brief description and goal of the type of work to be performed e.g., collection of samples, observation of animals/ environment, interviews with human subjects, etc.	Observation of birds in the field
Please provide details of the activities to be undertaken e.g., interviewing, quadrating, snorkelling, diving, rock climbing	Vantage point survey. Researcher will be set up at a location that overlooks the area of interest. Point count survey will be conducted using telescope and/or binoculars for 15 minutes each time.
Level of Risk of Fieldwork Please see risk categories in guidance document to determine the risk levels. This will determine the level of authorisation.	Moderate X High ☐

Additional forms included (see Staff H&S Pages or PG H&S Pages)	
Participant Declaration and Information Form (group travel only)	☐
International Travel Risk Assessment Form (where applicable)	☐

Insurance

Insurance: Please provide details of insurance cover. See guidance for further information. Email Insurance@Swansea.ac.uk	Swansea University Cover Staff - Insurance webpage Students - Insurance webpage University travel cover for overnight accomodation away from normal place fo residence.
	Additional insurance required: Yes ☐ No X If yes, please give details:

Location & Communication for Fieldwork

Location of Fieldwork(s): (This may be general location and NGR/GPS/what three words coordinates)	Milford Haven Waterway (Angle Bay, Pwllcrochan, Pembroke Dock, Coshenston Pill, Lawrenny)	
Nearest Town/ City: (Name, distance from site)	Milford Haven, Neyland, Pembroke Dock (max distance 18km)	
Mobile Phone Coverage https://www.gsma.com/coverage/	**Primary Number:**	[redacted]
	Coverage:	Good X Sparse ☐ None ☐
	If none, nearest location with coverage:	
Local contact details (if applicable)	Name:	
	Tel:	
	Email:	
Satellite phone/ device You must know how to contact emergency services via Sat Phone. 999/ 911 typically does not work.	Device Carried:	Yes ☐ No X
	Number:	
Radio	Radio Carried:	Yes ☐ No X
	Radio Channel:	
	Who can be contacted using this radio?	
Other: List any other communication devices/ methods that may be used**.**		

<table>
<tr><td>Nearby Facilities:
What facilities are available at or near the site: restrooms, water, public phone, shop?

If there are no facilities, where are the nearest welfare services/ what provisions will you have in place?</td><td colspan="2">No facilities at site.

Nearest shops, water and public toilets available in towns and villages surrounding. Snacks and water will always be kept in cars. Portable chargers will be kept in cars too.</td></tr>
<tr><td>Down Time (see guidance for definitions):
Are side trips planned or allowed during free time?

If yes, please describe the activities.
Are there restrictions, specific rules, or expected code of conduct? Have these activities been risk assessed? Is insurance in place for these activities?</td><td colspan="2">No side trips planned except for grocery shopping. Side trips for walks allowed. Walks fall into the same risk assessment as the planned fieldwork.</td></tr>
<tr><td colspan="3">Complete the shaded section below for: Fieldwork in the United Kingdom ONLY
This section is already included in the International Travel Forms</td></tr>
<tr><td rowspan="4">Swansea University Contact</td><td>Name:</td><td>Dr Richard Unsworth</td></tr>
<tr><td>Phone number(s):</td><td>[redacted]</td></tr>
<tr><td>Email:</td><td>[redacted]</td></tr>
<tr><td>Frequency of check ins:
e.g., Daily, at end of workday, etc. (State GMT or other)</td><td>Please specify.
Twice weekly</td></tr>
</table>

	Detail actions to follow if the traveller fails to make contact:	**First contact field assistants (phone number provided)** **Contact emergency contact to see if they have communication. If not**
Accommodation details If not known, please complete prior to travelling and share with your Swansea University contact.	[redacted]	
Emergency Contacts	Swansea University Security:	[redacted]
	SafeZone App:	Downloaded Yes x No ☐
	Travel Planet Emergency Number:	[redacted]
Personal Emergency Contact details (if applicable) Only complete if sole fieldworker, group leader. Group information will be collected on participant information form.	Phone:	[redacted]
	Email:	[redacted]

Fieldwork Risk Assessment

This risk assessment relates to the activities you will be carrying out during your fieldwork in the countries you are visiting. See guidance for examples of things to consider in this section.

What are the hazards?	Who may be harmed? How may they be harmed?	Controls/ Mitigation	By Whom	By When
Road traffic accidents	Research, field assistants, other road users Physical injury	• Ensure the mode of transport has the appropriate insurances, licences • Check the mode of transport is road worthy prior to use • Ensure driver is alert and in fit state to drive • Check road and weather conditions	All parties	Prior to and during fieldwork travel
Slippery and/or uneven surfaces	Researcher and field assistants slips, trips and falls, causing cuts, bruises and/or broken bones	o Wear strong and sensible footwear. o Take care, especially on wet surfaces and loose screes. o Be aware of other potential trip hazards. o Adjust or abandon route if necessary.	All parties	During fieldwork activities
Weather (wet and cold)	Researcher and field assistants Hypothermia and illness	o Wear warm and waterproof clothing. o Carry spare clothing. o Carry survival bag/blanket. o Carry food and warm drink.	All parties	During fieldwork activities
Hazardous plants	Researcher and field assistants Scratches, stings, rashes, and/or thorns	Look out for brambles, gorse, rose and other thorny plants. Be aware of, and look out for hazardous/poisonous plants such as giant hogweed.	All parties	During fieldwork activities
Infection	Researcher and field assistants	o Clean skin wounds carefully with clean water and/or antiseptic wipes/cream.	All parties	During fieldwork activities

		o Carry simple first-aid kit.		
Fences and stiles	Researcher and field assistants Injury from tripping. Minor cuts/bruises from sharp surfaces. Shock from electric fences.	o Take care at all times. o Look out for sharp surfaces, barbed wire and electric fences. Avoid where possible.	All parties	During fieldwork activities
Tidal environment (mudflat/saltmarsh)	Researcher and field assistants Entrapment in mud, isolation by rising water, fast flowing water in gullies, hypothermia following accidental exposure to water, pollution, litter and debris leading to cuts and physical injuries.	o Plan and know the tidal times and tidal range for the day(s) of sampling. o Do not enter the tidal environment. It is not necessary for this research activity	All parties	During fieldwork activities
Public interaction	Researcher and field assistants Aggression, physical injury, assault, mental trauma,	Be polite and try to de-escalate if possible. Assess risk and apply appropriate lone working procedures. Leave site immediately if any danger suspected. Report suspicious behaviour	All parties	During fieldwork activities
Coronavirus	Researcher and field assistants People can catch COVID19 from others who have the virus. These people may be symptomatic or asymptomatic. Worst case, this may be fatal, illness of varying degrees. Refer to NHS website for symptoms	Comply with Country / Local coronavirus restrictions. Wales: https://gov.wales/covid-19-alert-levels • Do not attend fieldwork if you have coronavirus symptoms (New and continuous cough / high temperature / loss or change of taste or smell) • Do not attend fieldwork if someone in your household has coronavirus symptoms, or you have been told to self-isolate by Test, Trace and Protect.	All parties	During fieldwork activities

		• Check for updates: https://myuni.swansea.ac.uk/coronavirus-studentfaqs/ Hands / Face / Space / Fresh air • Wash hands frequently and always before eating / drinking. Use hand sanitizer or soap and water. Avoid touching your face with unwashed hands. • Cover your nose and mouth with a tissue or your elbow (not your hands) when you cough or sneeze.		
Using telescope/binoculars for long periods of time	Researcher and field assistants Eye strain	Take breaks between surveys. 20-20-20 rule where possible (look 20m away for 20 seconds every 20 minutes). Bring eye drops. Wear contact lenses where needed.	All parties	During fieldwork activities

Add additional boxes as required.

First aid requirements

Name	Contact number whilst in the field:	Qualification		First Aid Kit Carried	Specialist equipment carried? *If yes, please give details*	
		Tick the qualification held	Expiry Date			
Emma Butterworth	[redacted]	☐Fully Trained – First Aid at Work (3 days) x Emergency First Aid (1 day) ☐Mountain (wilderness) First Aid Trained (2 day) ☐Mental Health First Aid ☐Other – *please specify*	05/2026	X Yes ☐No	☐Yes x No	
		☐Fully Trained – First Aid at Work (3 days) ☐Emergency First Aid (1 day) ☐Mountain(wilderness) First Aid Trained (2 Day) ☐Mental Health First Aid ☐Other – *please specify*		☐Yes ☐No	☐Yes ☐No	

Add additional boxes as required.

Training and Competency Requirements

List here any specific training or qualifications that need to be achieved as part of this fieldwork. This will have been identified during risk assessment above.

Training	**Required for (supervisors /participants/skipper or named individual etc)**	**Achieved**		**Training date if applicable**
		Yes	**No**	
Example - Water safety	*Participants*	☐	☐	*22.02.22*
		☐	☐	
		☐	☐	
		☐	☐	

		☐	☐	

Add additional boxes as required.

Emergency Planning

Nearest Hospital(s) (to field working site) information: (Include name, distance from site, phone number, address, and postal code).	Withybush Hospital Fishguard Road Haverfordwest SA61 2PZ 36km from site 01437 764545
Emergency evacuation plan for site: Where abstraction may be difficult provide details of your evacuation plan and transportation options to the nearest hospital.	x if not applicable check the box.

Fieldwork Contingency Planning

If the fieldwork risk assessor becomes unable to lead the group for any reason e.g., becomes ill. What contingency do you have in place? i.e., will the students be able to continue/return to accommodation etc.?	Field assistants are unable to continue with research alone. Field assistants are independent adults and make their own transport/accomodation arrangements. Fieldwork activities will pause until researcher is well again.
If disruption to your fieldwork/ research has financial implications, what contingency do you have planned?	n/a

Equipment List

It is important the equipment list is completed in full. If something happens to the equipment in transit or it is stolen, then there is a record of equipment that can be provided to the University insurers.

Use this list to specify items of clothing/footwear, include also, sun creams, water bottles, mobile phones. Specify items of equipment that will be taken by fieldwork organiser such as life jackets first aid kits, GPS equipment, sample pots etc. Include items of communication equipment such as mobile phones, satellite phones, etc.

Item	Provided by participant	Provided by the University	Sourced locally
Zeiss SFL 10x40 binoculars	☐	☐	X
Vortex Diamondback HD 10x42 binoculars	X	☐	☐
Vortex Diamondback HD 20-60x85 Angled Spotting Scope	☐	☐	X
Manfrotto tripod	☐	☐	X
Slik Sprint Mini II tripod	X	☐	☐
Google Pixel 4a 5G	X	☐	☐
First Aid Kit	X	☐	☐
Chillys 500ml waterbottle	X	☐	☐
Camping chair	X	☐	☐
Helly Hansen waterproof sailing overtrousers	X	☐	☐
Gill OS2 Offshore jacket	X	☐	☐
Weatherwriter	X	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Add additional boxes as required.

Brief Itinerary

01/02/2024	Home - Bridgend, [redacted]	06:00	Dinas Cross	10:00	[redacted]	Personal car	Base location for all surveys
29/02/2024	Dinas Cross	11:00	Home - Bridgend, [redacted]	15:00	[redacted]	Personal car	End of fieldwork

Fieldwork Declarations

Field Risk Assessor(s):			
When signing this document, as the Field team leader you are confirming you: • Have personally, considered and understand the nature of the risks and the potential impact(s) and have considered steps to reduce and mitigate the risks associated with the fieldwork. • Have completed a suitable and sufficient fieldwork risk assessment. • Are fit to undertake the activity/ fieldwork, are not participating against medical advice and reasonable adjustments have been agreed where required. • All information and responses given are true and accurate to the best of my knowledge and belief. • If group leader, will ensure the information is shared with all participants, and will ensure the participant declaration and information form, and health declarations (where appropriate) are completed prior to travel. • All information and responses given are true and accurate to the best of my knowledge and belief.			
Name:	**Signature:**	**Faculty**	**Date:**
Emma Butterworth	[redacted]	Science and Engineering - Bioscience	26/02/2024

Once completed please send to the appropriate Faculty/ PSU teams for approval.

Fieldwork Authorisation

If the Fieldwork involves more than one Faculty/ PSU. Authorisation is required for all Faculty/ PSU's involved.

Approver		
By signing this document, I am confirming I have read the fieldwork risk assessment and I am satisfied that the proposed reasonable precautions are in place for the activity.		
Approval Moderate Risk:		
Line Manager/ Supervisor	**Name:**	Dr Richard Unsworth
	Signature:	[redacted]
	Faculty/PSU:	Science and Engineering - Bioscience
	Date:	26/02/2024
Head of department /Programme Director	**Name:**	

	Signature:	
	Faculty/PSU:	
	Date:	
High Risk:		
Head of School/ Director of PSU OR Head of L&T/ Research	**Name:**	
	Signature:	
	Faculty/PSU:	
	Date:	

Appendix 1 - Accommodation Safety

Field Course Leader Accommodation Safety Checklist		
If it has not been possible to verify the safety standards of accommodation through an approved travel agent, completing this form using the Fieldwork guidance document is one method you can use to help establish whether acceptable standards are in place. **Please complete the table below, *if required*, to confirm that an assessment has been completed:** ☐ This is not required		
	Checked	Comments
Fire Safety	x	Fire alarms tested
Security	x	All external doors lock with key.
Building Safety Issues	x	None
Local Environment	x	Very safe area, rural village.

X I have completed the review and consider that the accommodation is safe to use.

☐ I have considered and noted relevant points to include in the fire brief to fieldworkers on arrival.

☐ **This accommodation must be assessed on arrival.**

References

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