MILFORD HAVEN WATERWAY
ENVIRONMENTAL SURVEILLANCE GROUP

GRŴP CADW GOLWG AMGYLCHEDDOL
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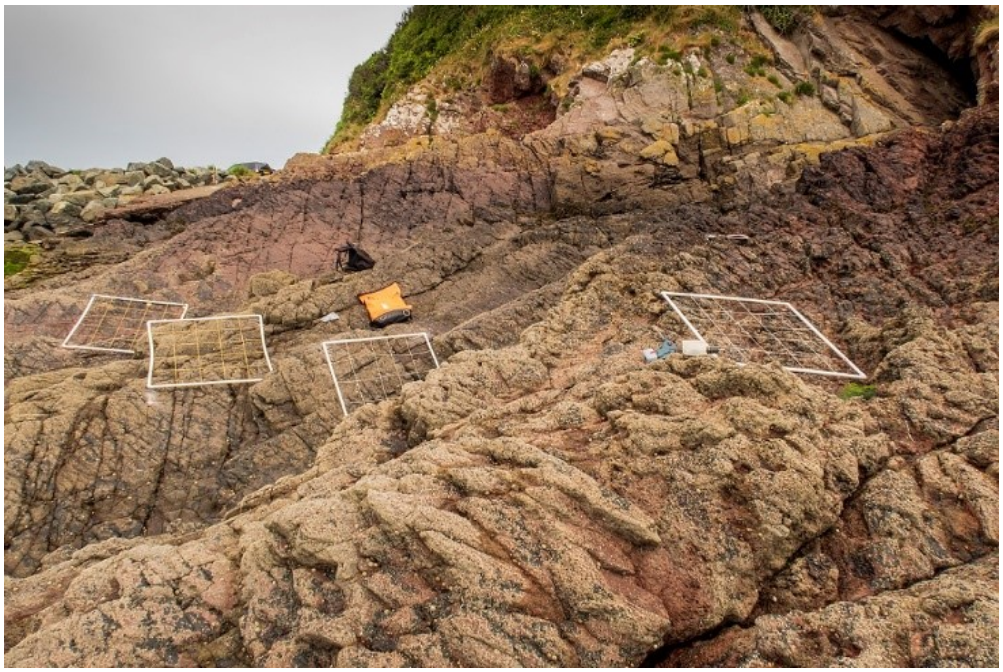

Annual Report 2020

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Annual Report 2020

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COVER IMAGES

Front cover: Placement of quadrats for the rocky shore survey at Gelliswick in 2020. Photo: John Archer-Thomson

MILFORD HAVEN WATERWAY ENVIRONMENTAL SURVEILLANCE GROUP

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Contact the MHWESG by e-mail at
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Pembrokeshire Marine SAC officer

Skomer MCZ personnel in NRW

Skomer MCZ Advisory Committee Chair

Milford Haven Waterway Environmental Surveillance Group
Report 2018

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Chair's Foreword

2020 was an interesting year in many ways. COVID was and continues to be devastating but the forced slow down in economic activity had a beneficial impact on the world environment and allowed many people to re-connect with nature and their local environment. This can only be a good thing.

As I cast my eye over our Terms of Reference (TOR) in the context of the new COVID world, I am pleased to say that by taking appropriate precautions and adopting an innovative approach we managed to complete our planned work and deliver on our TOR.

The inexorable pace of climate change brings into sharp focus the importance of completing our work programme to ensure we maintain continuity of long term datasets. From these we can assess the impact of climate change. However it is not easy as there are many other confounding variables that also play a part but I'd like to think the work of the MHWESG is one piece in the jigsaw!

2021 will be a busy year with several resource intensive, but important projects, continuing. I can only hope that our inventiveness and persistence demonstrated in 2020 enables us to complete at least the field work. I look forward to the results and I hope you will too.

Paul Howells, Dragon LNG Ltd

Chair MHWESG

Rhagair y Cadeirydd

Roedd 2020 yn flwyddyn ddiddorol mewn amryw o ffyrdd. Roedd COVID yn ddinistriol ac mae'n parhau i fod felly. Er hynny, roedd yr arafu a orfodwyd ar weithgaredd economaidd o fudd i amgylchedd y byd a chaniataodd i nifer o bobl ail gysylltu â byd natur ac â'u hamgylchedd leol. Gall hyn ond bod yn newyddion da.

Wrth i mi fwrw golwg dros ein Amodau Gorchwyl (AG) yng nghyd-destun y byd COVID newydd, rwy'n falch o ddweud ein bod, trwy gymryd y gofal perthnasol a thrwy fabwysiadu dull arloesol, wedi llwyddo i gwblhau'r gwaith roeddem wedi'i gynllunio ac i gyflawni nod ein AG.

Mae cyflymder diatal newid hinsawdd yn tanlinellu pwysigrwydd cwblhau ein rhaglen waith er mwyn gwneud yn siŵr ein bod yn cynnal parhad setiau data tymor hir. Gallwn ddefnyddio'r rhain i asesu effaith newid hinsawdd. Nid yw'n hawdd, fodd bynnag, gan fod yna nifer o newidynnau dryslyd eraill sydd hefyd yn chwarae eu rhan, ond buaswn yn hoffi meddwl fod gwaith MHWESG yn un darn o'r jig-so.

Bydd 2021 yn flwyddyn brysur gyda nifer o brosiectau pwysig, fydd yn gofyn am lawer o adnoddau, yn parhau. Ni allaf ond gobeithio y bydd ein dyfeisgarwch a'r gwaith diflino a wnaethpwyd yn 2020 yn ein galluogi i gwblhau o leiaf y gwaith maes. Rwy'n edrych ymlaen at weld y canlyniadau ac rwy'n gobeithio eich bod chithau hefyd yn edrych ymlaen at hynny.

Paul Howells, Dragon LNG Ltd

Cadeirydd MHWESG

1. Introduction

This is the 20th report of the Milford Haven Waterway Environmental Surveillance Group. It covers the period January to December 2020.

The main project for 2020 was a review of the annual summer shelduck survey, including nearly 30 years of data, carried out by the British Trust for Ornithology (section 2.1). The rocky shore survey and the shelduck survey reports are summarised in sections 2.2 and 2.3 respectively. BTO volunteers managed to complete their scheduled surveys before the start of lockdown and a report for this data is available in section 2.4.

Other non MHWESG related environmental projects in the Milford Haven Waterway are included in section 3.

More general information on the MHWESG and summaries of reports are available at http://mhwesg.org.uk. Full reports for all MHWESG commissioned work are available from mhwesg@gmail.com.

2. MHWESG projects 2020

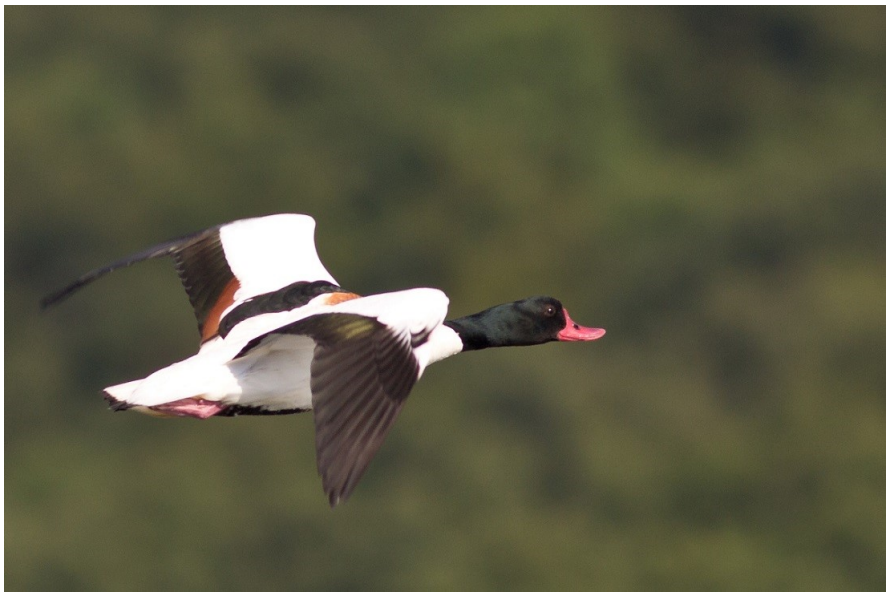
2.1 British Trust for Ornithology review of MHWESG Shelduck data (1992 – 2019) for the Milford Haven Waterway, Pembrokeshire

Ros Green, Niall Burton & Aonghais Cook, British Trust for Ornithology

Executive Summary

The Daugleddau Estuary and Milford Haven Waterway (the estuary system) has historically held nationally important numbers of wintering Shelduck within Great Britain. This is no longer the case however as the five-year mean count between 2014/15-2018/19 (387) represents a decline in numbers from the mean peak of 1,564 between 1982/83-1986/87. A small breeding population of Shelduck using the estuary system has been the subject of a systematic annual survey commissioned by the Milford Haven Waterway Environmental Surveillance Group (MHWESG) from 1992 to 2020. In addition to commissioning long-term environmental surveillance projects, the MHWESG also carry out periodic reviews and analysis of its data so that MHWESG members can use the data to inform management decisions. It is for this reason that the BTO were invited to provide an independent evaluation and review of the annual summer Shelduck surveys that have been carried out between 1992 and 2019.

The objectives outlined for this report were (i) Review and analyse the data obtained during the summer surveys between 1992-2019; (ii) Evaluate the survey methodology employed over this same period; and (iii) Provide recommendations to the MHWESG to inform the future surveillance of the Shelduck population on the estuary system.



Shelduck, *Tadorna tadorna*, in flight. Image: M. Camplin

The dataset was of sufficient quality to produce robust trends in the numbers of ducklings, broods and adults present on the estuary system during the survey period. The trends in these figures all broadly matched each other, with a large peak in numbers, followed by a decline then smaller peak, and then a decline below initial count figures, followed by an increase returning to the approximate population size counted at the beginning of the survey period. Robust national trends for Shelduck are only available from the Wetland Bird Survey for adults counted in winter. The trends in the estimated number of adults present during the MHWESG surveys were well correlated with national trends for Wales, and also the entire UK.

The survey methodology employed seems very robust, and only minor amendments to data recording are recommended. The long-term MHWESG Shelduck dataset is unique within Wales so there is value in continuing the survey in its current format on that merit alone. If

resource availability becomes a limiting factor, then recommendations for reducing the frequency of surveys are outlined.

Recommendations are made for improvements in data recording and curating, for future analyses that would be possible with this dataset and which would benefit the current poor level of understanding about Shelduck populations nationally. Options for developing the project further are also outlined, which would give the dataset even more power and increase the profile of MHWESG. Publishing results from this dataset is a key recommendation, as this would make the MHWESG dataset more widely available, in a research area with a paucity of data.

In conclusion, the BTO recommend that the MHWESG annual Shelduck survey continues in its current format, and that the data be made more widely available as they are unique and valuable.

2.2 Milford Haven Waterway Rocky Shore Surveillance, 2020

J.H.S. Archer-Thomson and Dr S.L. Morrell

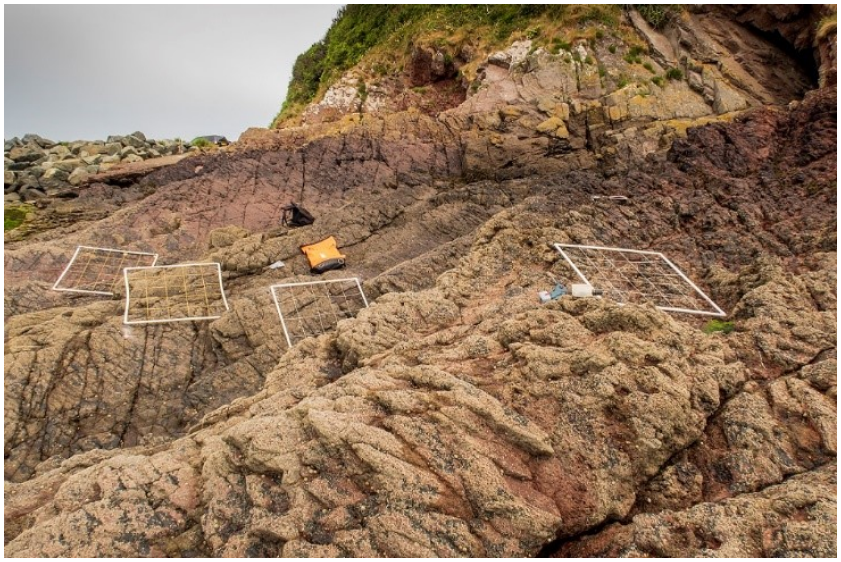
Executive Summary

Six rocky shores within the Milford Haven Waterway were surveyed by the authors and colleagues on behalf of the Milford Haven Waterway Environmental Surveillance Group. Field surveys were carried out between 20th and 25th of July 2020. This repeated the work carried out by the Marine Biological Association of the UK in 2010, the Field Studies Council in 2013 and the present authors in 2017. The same methodology was used with the exception that for this and subsequent surveys, fixed quadrat positions have been adopted for the main survey (see methods). These were established before the biological data was collected.

The results were analysed and compared with those from previous surveys.

There was close agreement in the overall community composition between 2013, 2017 and 2020. This suggested a generally stable situation between the surveys and underlined the benefits of having the same personnel carry out the work. There were, however, some indicators of change. There were modest increases in species numbers, including the appearance of *Undaria pinnatifida* and increased abundance of *Caulacanthus okamurae*, for example, both of which are non-native.

The pattern of high biodiversity at the open coast sites (Dale Point and Great Castle Head) decreasing up the Milford Haven Waterway was consistent with previous surveys. The higher diversity usually associated with increased shelter (from wave action) may have been offset by variations in salinity, increased turbidity and deposition of fine sediment.



Survey quadrats *in situ*. Image: John Archer-Thomson

Barnacle percentage cover results were similar to those of 2013 and 2017. *Semibalanus balanoides* dominated on the open coast and *Austrominius modestus* dominated in the upper reaches of the Milford Haven Waterway. This was in line with expectation as *A. modestus* is tolerant of salinity fluctuations and turbid water. The abundance of juvenile barnacles mirrored that of the adult distributions with *S. balanoides* doing well on the open coast and *A. modestus* up the Milford Haven Waterway. *Chthamalus* spp. were most abundant on south-facing, exposed coasts as expected and as observed previously.

The observed trend of high limpet densities on the exposed sites, reducing with increased shelter continued from the previous surveys. Similarly, maximum limpet diameters showed an inverse relationship with limpet density. Once again there was a positive relationship between limpet density and barnacle cover and a negative relationship between limpet density and macro-algal cover.

Field observations, confirmed when the data was analysed, did show an increase in numbers of *Patella depressa* compared with those of *P. vulgata*. This is in line with predictions on changes in relative abundance of these two species as the climate warms.

For *Ascophyllum nodosum* at Cosheston Folly, Sawdern Point and Llanreath the vesicle number modal class fluctuated. There was also evidence that individuals had survived from the previous survey resulting in higher vesicle counts. At Sawdern Point there were few individuals with small numbers of vesicles indicating poor recruitment, possibly as a result of intraspecific competition for space. At Llanreath the unusual frequency distribution of vesicle numbers was partially maintained from the previous survey but the frequency distribution became bi-modal (having been uni-modal in 2017). The mean number of vesicles per individual in 2020 was significantly different at all sites (previously this only applied to Llanreath).

Surveys of Trochidae in 2017 produced broadly similar results to 2013. The main exception being the increased abundance of *Phorcus lineatus* and *Gibbula umbilicalis* at Sawdern Point. Other sites within the Milford Haven Waterway (monitored by the present authors) have shown increases in recent years. In 2020, numbers of *P. lineatus* at Sawdern Point (which had been increasing rapidly) seem to have stabilised. Nor was there much change in density of this species at Gelliswick. There was a large increase in density of *P. lineatus* at Dale Fort Jetty Beach. Density at Cosheston Folly showed a steady increase. Mean maximum diameter increased for both species at all sites except for Cosheston Folly.

Recommendations include increased frequency of surveys and continued consistency in personnel.

2.3 Daugleddau Estuary and Milford Haven Waterway: annual surveillance of summer shelduck populations 2020

Jane Hodges, Ecologist

Executive summary

The Daugleddau Estuary and Milford Haven Waterway hold regionally important numbers of shelducks during the winter months. There is also a small summer population that has been the subject of annual surveillance between 1991 and 2019. The summer shelduck survey was repeated in 2020 as part of a programme of environmental surveillance work in the estuary system coordinated by the Milford Haven Waterway Environmental Surveillance Group (MHWESG). The aims, objectives and methods used to carry out the annual surveillance, and the data obtained, are described in this report.

The results indicate that in terms of the number of broods seen in the estuary system (11), the 2020 breeding season was less successful than in 2019 (which was the best since 2006), although it was on a par with the 2018 breeding season. This suggests that the breeding population is fluctuating, although it may also point towards a decline following the modest recovery (in brood numbers) in 2019. The mean brood size of 5.8 ducklings per pair recorded in 2020 was also lower than that in 2019, and similar to that recorded in 2018.

As in previous years, predation (by avian and/or mammalian predators) is likely to have been a (or the most) significant factor affecting the numbers and sizes of broods recorded in the estuary system during the 2020 survey. Adverse weather conditions (e.g. heavy rain accompanied by low temperatures) in late April, May and June can impact on the survival of eggs to hatching and/or recently hatched ducklings. The spring in 2020 was, however, marked by largely dry, settled, warm weather and it is unlikely that adverse weather conditions were a significant factor affecting the number of ducklings making it onto the water or their survival once on the water.

Disturbance e.g. from recreational activities (on land and/or on the water) may affect breeding success and subsequent survival of ducklings, although there is little evidence to suggest that this was the case in 2020. Localised impacts of factors affecting the quality of foraging habitat such as the presence of dense mats of green macro-algae (linked to elevated levels of nutrients in the estuary system) on mud flats at low tide may have played a part in breeding success and duckling growth and survival.

The number of non-breeding shelducks recorded during the June survey was 14 which was significantly lower than in 2019, and is the lowest recorded since the annual surveillance of summer shelduck populations in the estuary system began in 1992. Numbers of shelducks present in the estuary system during the 2019/20 winter peaked at 393, slightly higher than in the previous winter (although still low). This suggests that following a steady decline over a number of years, the numbers of shelducks electing to over-winter in the estuary system has stabilised.

The relatively low numbers present in the winter may help to explain the low numbers of non-breeding shelducks recorded in June 2020, although reports from local observers suggest that non-breeders had left the estuary system shortly before the June survey.

Low numbers of shelducks in the winter months (hence low numbers of non-breeders present during the June survey) are most likely to be linked to regional/national trends, and be driven

by large-scale “external” (rather than local) factors such as prevailing weather conditions in north-west Europe and shifts in the annual moult grounds.

The report concludes with a recommendation that the annual surveillance of the summer shelduck population in the estuary system be continued as part of the MHWESG annual work programme. In addition to this recommendation, potential lines of inquiry into the distribution and abundance of the favoured prey of shelducks (the mud snail *Peringia ulvae)* and links to factors affecting environmental conditions in the estuary system are identified for further consideration by the MHWESG, individual group members or appropriate third party.

2.4 Wildfowl and wader counts on the Milford Haven Waterway 2019-2020

Annie Haycock, Pembrokeshire WeBS Coordinator

Executive Summary

The Wetland Bird Survey was carried out on the Milford Haven Waterway and Cleddau Estuary system (here-in after referred to as the Cleddau complex) between September 2019 and March 2020 with additional counts for June and July 2019 made by Jane Hodges during the annual survey of summer shelduck populations.

The methodology used followed that set out in the BTO WeBS Counters Handbook.

A total peak count of 23,420 birds between November and February confirms that the estuary system is still of international importance for its winter waterbird populations. Counts of migrating birds (notably curlew) in July takes this total to 25,244. This peak count is about average for the site, in winters considering a reasonable influx of lapwing and golden plover, but low numbers of wigeon and curlew.

The levels of "National Importance" for many water birds were revised in 2019, and only three species now qualify (based on a five-year mean): wigeon (max. 4755 in December), greenshank (max 55 in January), and Dunlin (4012 in January)

Curlew (1186 in July) were at their lowest level since 1999-2000, a reflection of the decline recorded across their range.

Shelduck (449 in March) were still well below the qualifying level.

Wigeon numbers seemed to have recovered from the low counts in 2013-15, but have now declined again. This is reflected in counts across the UK. The peak count was in December, perhaps the food supply lasted longer with fewer birds at the table.

The changes in the national importance threshold levels mean that teal no longer qualify, however, the Cleddau complex is still the most important site for teal in Wales, as it is for wigeon.

The total number of birds recorded in September and October was lower than the average of the past twenty years. From November to February, numbers were higher than average, boosted by good counts of lapwing and golden plover, and by the wigeon staying on into December (often many of them have left the estuary before the December count).

Comparison of counts with the national report for 2018-19 (the most recent that is available on the BTO website) show that for most species, the local population trends are similar to those experienced nationally.

3. Other activity in the waterway

3.1 Porcupine Marine Natural History Society field trip at Dale, 2020

Sarah Bowen, Honorary Secretary of the Porcupine Marine Natural History Society
Kate Lock, member of Porcupine Marine Natural History Society

The annual Porcupine field trip was able to go ahead thanks to a temporary relaxation on rules for outdoor meetings during the summer of 2020. A weekend of shore surveys was welcomed by participants who had come from as far afield as Glasgow, Plymouth and Cambridgeshire to enjoy the sunshine.

Porcupine Marine Natural History Society

We are an informal society interested in marine natural history and recording, particularly in the North East Atlantic region and the Mediterranean Sea. Porcupine MNHS welcomes anyone interested in marine biology and ecology.

The name "Porcupine" is taken from the naval survey vessel HMS Porcupine which was engaged on scientific expeditions in the N.E. Atlantic and Mediterranean in 1869 and 1870. She made the first ever deep ocean dredge for living creatures in 1869 resulting in the naming of the Porcupine Bank off the west coast of Ireland.

The aims of the Porcupine Marine Natural History Society are:

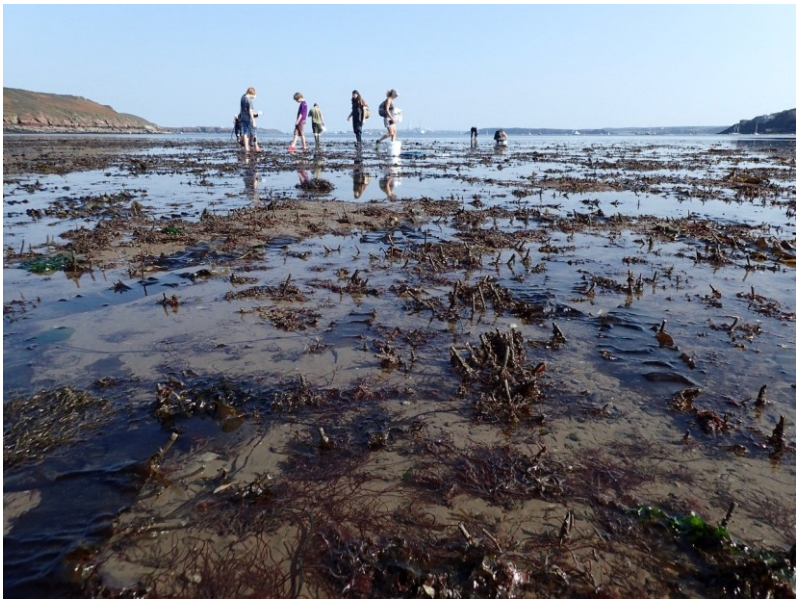
- To promote a wider understanding of the biology, ecology and distribution of marine organisms.
- To stimulate interest in marine biodiversity, especially in young people.
- To encourage interaction and exchange of information between those with interests in different aspects of marine biology, amateur and professional alike.

For more information, see http://pmnhs.co.uk/

The plan on day 1 was to survey the shoreline to the south of Dale Bay at the furthest reaches of low tide. At the tip of Dale Bay is Dale Fort field centre run by the Field Studies Council, which published the Dale Fort Marine Fauna in 1966 (Crothers 1966). Over the years the shores have been surveyed with a range of student projects set up to monitor limpets and winkles as well as barnacles. But no comprehensive general survey has been carried out recently.

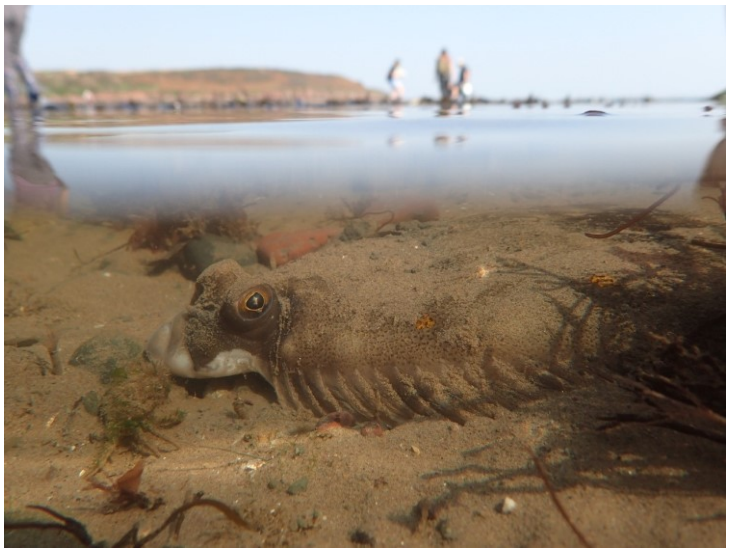
Another reason for choosing this area was to expand the survey work carried out by Aran Lock and friends (reported in the Spring 2020 Porcupine Bulletin), targeting fish in particular. Once more, Aran had gathered a group of his friends together to search for fish and crustaceans. To add to their day, they were being filmed for an upcoming BBC Wales television series to be called 'The Wonders of the Celtic Deep', which will include Aran in an episode featuring marine 'personalities' (due to be aired in autumn 2021).

Dale shore is an interesting area to explore due to the range of habitats and substrates. In the upper shore steep old red sandstone bedrock is found leading down to a middle shore dominated in boulders of all sizes and as the tide drops a vast area of mixed muddy sediments is exposed. Everyone divided into small workable teams and spread out over the shore, many concentrating initially on the middle shore to study the under-boulder communities. Boulders were carefully turned to record both the encrusting and mobile animals taking refuge.



Porcupine surveyors at Gann Flats. (Photo: Sue Burton)

Crabs were prolific in the muddy pools under the boulders, notable were the high numbers of *Necora puber* and *Lophozozymus incisus* and a lonesome lobster *Homarus gammarus* hiding under seaweeds. An incredible 55 Arthropod species were recorded, primarily thanks to the dedication of Adam Jenkins collecting samples from algal scrapes and washes for further investigation. Adam noted the assemblage was fairly typical of inter-tidal shores but was surprised to see *Ammothella longiocculata* as it is not one of the usual pycnogonids found and *Lekanesphaera levii* given how muddy the habitat was. *Limnoria quadripunctata* is also fairly unusual as only found in waterlogged wood. Aran and his team did a fine job wrestling both *Conger conger* and *Anguilla anguilla* from the muddy pools under large boulders. They also used a large sweep net in the shallow waters which helped catch an impressive 18 species of fish. Notable all along the shore were the high numbers of worm pipefish *Nerophis lumbriciformis*.



Plaice, *Pleuronectes platessa*, at Gann Flats. Photo: Sue Burton)

As the tide dropped, the muddy sediment lower shore was exposed and one of the most striking aspects was being able to wade out across the bay at such a low tide to see the vast expanse of tubeworms, *Sabella pavonina*. Also thriving exploring this habitat were Teresa Darbyshire and Anna Holmes from the Amgueddfa Cymru - National Museum Wales who were equipped with spades to collect and record burrowing worms and bivalves. Their specialist knowledge of polychaete worms and bivalve molluscs certainly boosted the overall species list.

Sunday's venue was nearby, at The Gann Flats to the north side of Dale bay. A popular bait-digging spot, there were plenty of fishermen out as well as the slightly reduced number of Porcupines. A wide-open expanse of mud with small stones and red algae was overlooked by the chimneys of the power station on the other side of the bay. As usual, Porcupines spread themselves out and began exploring. Once again, much digging for worms and molluscs took place.

Some non-native species were recorded, *Crepidula fornicata*, *Styela clava*, *Grateloupia turuturu* and *Sargassum muticum*, not surprising considering the proximity to Milford Haven Waterway. Highlights were a stalked jellyfish, *Calvadosia campanulata* and a large plaice, *Pleuronectes platessa* camouflaged underneath some sugar kelp in the shallows.

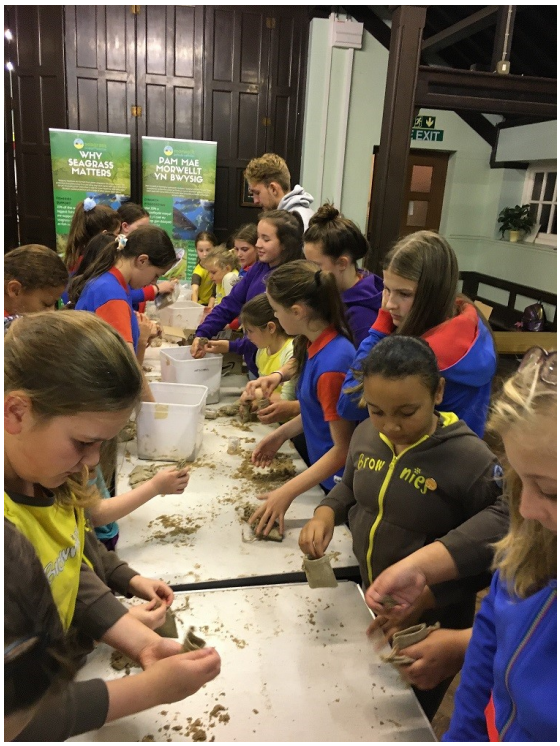
A few members of the group sat in the sunshine at the end of the afternoon to discuss their finds before heading home. With some long journeys ahead, several Porcupines had set off earlier. So, many thanks to Kate Lock for putting together a much-needed weekend for catching up and the opportunity to do what Porcupines do best – messing around on the shore in search of rare and unusual marine life.

3.2 Dale seagrass restoration by Seagrass Ocean Rescue

Report by Sue Burton, Pembrokeshire Marine SAC officer

Seagrass Ocean Rescue is a joint venture between Sky Ocean Rescue, WWF and Swansea University. They funded the Dale seagrass restoration project, including commissioning Pembrokeshire Coastal Forum and the Pembrokeshire Marine Special Area of Conservation (SAC) Officer to assist with stakeholder planning and engagement.

In February 2020, following local community liaison and a formal consultation for the official licensing process, the required marine licence from NRW was granted and planting took place in the following weeks. Approximately 750,000 seeds were planted within an agreed 2-hectare area within Dale Bay making this the first seagrass meadow restoration project in the UK. A further 450,000 or so seeds were planted in October 2020 bringing the total number of seeds planted to over 1 million.



Local girl guides from Milford Haven filling bags of sand in readiness for seed planting (photo: Sue Burton)

Monitoring at the site in September reported a lot of mature plants present in the restoration area with some dense clumps. However, unfortunately there was not the rapid success hoped for and germination was a lot slower than hoped for with some patches performing poorly. This was probably due to delayed planting and winter seed storage (reducing the viability of stored seeds and overall germination success) whilst agreements and licensing were underway. Further germination was expected after the winter as the seeds are subjected to 'scarification' (scaring of the seeds by the sand grains).

The Dale Seagrass Stakeholder Group has been set up to support ongoing management of the trial restoration area. The trial area is currently marked with temporary orange buoys, but three visitor moorings would be installed on the Eastern edge of the site, along with some additional signage buoys to indicate the boundary of the zone. The Group were exploring options to set up voluntary donations for use of the visitor buoys, which could contribute towards future maintenance.

Aside from addressing the practicalities of planting, the restoration trial also prompted important policy discussions regarding the status of restored seagrass and culminated in an addendum to the SAC management scheme to satisfy and reassure concerns about future management from local interests.

Project information is available on the PCF hosted webpage.
https://www.pembrokeshirecoastalforum.org.uk/seagrassoceanrescue/

4. Work programme 2021

If it all goes to plan, 2021 should be a busy year for field work. Projects scheduled on a triennial basis are due to be repeated in September 2021. These include sampling sediment macrobenthic communities at 8 stations along the axis of the central waterway of the Milford Haven Waterway, and also the surface sediment sampling programme initiated in 2018.

In 1987 the Institute of Petroleum commissioned a study of isotope dated deep cores in the waterway with the aim of assessing the importance of oil industry contaminant inputs relative to urban and light industry sources. The MHWESG plan to repeat this work in 2021-2022, but with a slightly different objective of determining the status of sediment contamination generally over the last few decades, with particular emphasis on banned contaminants e.g. tributyl tin (TBT) and dichloro-diphenyl trichloroethane (DDT) and emerging contaminants.

To help inform contaminant related projects in the Milford Haven Waterway, the MHWESG intend to commission a desk-based review of contaminants in early 2021, including emerging and catchment sourced contaminants relevant to the Milford Haven Waterway.

A British Trust for Ornithology review of the annual summer shelduck survey in 2020 strongly recommended the continuation of this survey. Therefore this annual summer shelduck survey, as well as the annual wetland bird report are also scheduled for 2021.

The implementation of these projects is subject to there being sufficient available finances and also the absence of corona-virus restrictions.

Appendices

Appendix 1: Purpose and terms of reference

The Milford Haven Waterway[1] is an extensive natural inlet of the sea with a long and distinguished maritime history. Its deep waters provide a natural harbour of significant economic importance. It is one of the best examples of a ria system in Britain and supports a particularly diverse range of high quality marine and estuarine habitats and biological communities.

The identification and consideration of political and management issues or the setting of environmental standards are specifically excluded from these Terms of Reference. However, group members are free, and are expected to use the group's outputs to help meet their own requirements.

Purpose

To provide high quality environmental information to enable members of the Group, and other authorities and industry working in and adjacent to the Waterway, to contribute to the maintenance and enhancement of the rich and diverse marine environment of the Waterway.

Terms of Reference

The Milford Haven Waterway Environmental Monitoring Steering Group will:

1. Maintain surveillance of the quality of the marine physico-chemical environment, marine biology and ornithology of the Milford Haven Waterway

2. Undertake surveillance of the foreshore, seabed and waters of the Milford Haven Waterway from a line between St Anne's Head and Sheep Island to the tidal reaches of the Eastern and Western Cleddau Rivers and other tributaries to normal tidal limits by:

2.1 keeping under review all relevant survey, surveillance and monitoring;

2.2 commissioning surveys to fill gaps in knowledge and to establish baselines;

2.3 undertaking surveillance projects;

2.4 maintaining a literature and information database.

3. Jointly maintain, and keep under review, a prioritised programme of survey and surveillance projects.

4. Share technical output equally under joint ownership and copyright.

5. Function as a technical, science based, group.

6. Form and appoint specific sub-groups to undertake specific responsibilities as required.

[1] The term Waterway in this document specifically refers to the waters, seabed and foreshore of the Milford Haven Waterway and the Daugleddau Estuary from a line between St Anne's Head and Sheep Island to the tidal reaches of the Eastern and Western Cleddau Rivers and other tributaries to normal tidal limits.

7. Publish an annual report which will comprise a summary of work undertaken, the executive summaries from individual project reports, a financial statement and the planned work programme.

8. Make its output available to the wider community in addition to its membership.

Membership and Funding

Membership is comprised of statutory authorities, industry and others with an interest in the environmental quality of the Waterway. Membership will be at the invitation and discretion of the Group's existing members.

Each member will contribute to the functioning of the group, either in monetary terms or 'in kind'.

Appendix 2: Milford Haven Waterway Environmental Surveillance Group Knowledge Collaboration Agreement

Agreement dated 17 January 2017 between:

1) Dragon LNG Limited
2) Milford Haven Port Authority
3) Natural Resources Wales
4) Pembrokeshire Coast National Park Authority
5) Pembrokeshire County Council
6) Puma Energy (UK) Ltd
7) RWE Generation UK Plc
8) Semlogistics Milford Haven Ltd
9) South Hook LNG Terminal Company Ltd
10) Valero Energy Ltd

PREAMBLE

The Milford Haven Waterway is an extensive natural inlet of the sea with a long and distinguished maritime history. Its deep waters provide a natural harbour of significant economic importance as a port handling strategic energy resources and ferry services sustaining many valuable long-term jobs in Pembrokeshire. It is one of the best examples of a ria system in Britain and supports a particularly diverse range of high quality marine and estuarine habitats and biological communities.

RECITALS

(A) The Group Members agree to work collaboratively in a non-binding knowledge collaboration as the **Milford Haven Waterway Environmental Surveillance Group** in order to provide high quality environmental information to the Group Members, so enabling the Group Members to contribute to the maintenance and enhancement of the rich and diverse marine environment of the Waterway whilst sharing this information with the local and scientific communities, and to perform the objects set out in clause 3.2.

(B) This Agreement serves to continue the successful collaborative Milford Haven Waterway Environmental Surveillance Group that began with establishment of the Milford Haven Waterway Environmental Monitoring Steering Group in 1991 and resulted in a Memorandum of Agreement being entered into by the members of the Group on 1 July 2004.

(C) The Memorandum of Agreement has gradually been overtaken by time and is now recognised as being insufficiently flexible for an evolving membership.

(D) Accordingly, on the date of this Agreement the Group Members have agreed to terminate the Memorandum of Agreement on the basis that the Group would be reconstituted as a non-binding knowledge collaboration Group in order to continue fulfilling the Objects of the Group.

(E) Consequently, the Group Members have agreed to enter into this Agreement on the terms and conditions set out below.

The Group Members agree as follows:

1 INTERPRETATION

1.1 In this Agreement, unless there be anything in the context inconsistent therewith the following expressions shall have the following meanings:

"Committee" has the meaning ascribed to it by clause 4.1;

"Group" means the Milford Haven Waterway Environmental Surveillance Group reconstituted under this Agreement and any agreement supplemental to it;

"Group Members" means all of the parties listed on page 2 of this Agreement and Group Member shall have a corresponding meaning;

"Intellectual Property" means all intellectual property rights of whatever nature including without limitation copyright, patents, know-how, trade secrets, trademarks, trade names, design right, get-up, database right, utility models, service rights, moral rights, domain names and all similar rights and, in each case:

a) whether registered or not;

b) including any applications to protect or register such rights and the right to make such applications;

c) including all renewals, continuations and extensions of such rights or applications;

d) whether vested, contingent or future; and

e) wherever existing;

"IP Rights" all rights which may now or in the future subsist in respect of or derived from any Intellectual Property.

"Memorandum of Agreement" means the Memorandum of Agreement dated 1 July 2004 entered into between the parties;

"Objects" means the objects of the Group itemised in clause 3.2;

"Waterway" means the waters, seabed and foreshore of the Milford Haven Waterway and the Daugleddau Estuary from a line between St Anne's Head and Sheep Island to the tidal reaches of the Eastern and Western Cleddau Rivers and other tributaries to the normal tidal limits.

2 TERMINATION OF THE MEMORANDUM OF AGREEMENT

2.1 The Group Members agree that as at the date of this Agreement the Memorandum of Agreement shall immediately terminate and be replaced by the terms and conditions contained in this Agreement.

2.2 From the date of this Agreement any monies held pursuant to the Memorandum of Agreement shall be subject to this Agreement and in particular the terms of clause 5.2.

3 SCOPE OF THE COLLABORATION

3.1 The Group Members agree with one another to enter into this Agreement to generate and share high quality environmental information to assist the Group Members to contribute to the maintenance and enhancement of the rich and diverse marine environment of the Waterway and to perform the objects set out in clause 3.2 under the terms of this Agreement.

3.2 The Objects of the Group are to maintain surveillance of the quality of the marine physico-chemical environment, marine biology and ornithology of the foreshore, seabed and waters of the Milford Haven Waterway, by:

a) keeping under review all relevant surveys, surveillance and monitoring;

b) undertaking surveys to improve current knowledge and establish baselines;

c) undertaking surveillance projects;

d) maintaining a literature and information database.

3.3 The Group will:

a) maintain under review a work programme of agreed projects;

b) share technical output equally under joint ownership and copyright;

c) function as a technical, science based, group;

d) make its findings available to the wider community in addition to the Group Members.

3.4 Membership of the Group comprises statutory authorities, industry and others with an interest in the environmental quality of the Waterway. Membership will be at the invitation and discretion of the Group's existing members.

3.5 Any Group Member may, at their discretion, share with the other Group Members any information and /or data generated by their own environmental survey, monitoring or surveillance activities. In these instances, any such member shall retain its IP rights to that information or data. However, for the avoidance of doubt, this clause does not constrain the Group's use of information provided by any member to regulatory authorities, for example to meet statutory consenting processes, which has thereby entered the public domain.

3.6 For the avoidance of doubt:

a) any survey, surveillance and monitoring agreed by the Group will be limited to crown foreshore, seabed and/or waters of the Waterway and will specifically exclude the premises, whether freehold or held under the terms of a commercial operating lease or license of any Group Member;

b) nothing in this Agreement shall be deemed to override or in any way restrict the statutory obligations of any of the Group Members;

c) the identification and consideration of political and management issues or the setting of environmental standards are specifically excluded from this Agreement. However, Group members are free, and are expected to use the Group's outputs, to help meet their own requirements.

4 CONTROL AND MANAGEMENT

4.1 A Committee comprising of one or more representatives nominated by each of the Group Members will be maintained for the purposes of:

a) discussing, determining and approving the purpose, terms of reference and work programme of the Group;

b) exchanging information;

c) implementing the agreed work programme;

d) reporting on progress, including publishing an annual report that comprises of a summary of all work undertaken for the year and work planned for the forthcoming year.

4.2 Each Group Member shall notify the Chairperson, or Secretary, in writing of their nominated representative and shall be entitled to appoint alternative representatives.

4.3 The Committee shall appoint a chairperson from its number to chair Committee meetings and a vice chairperson to chair committee meetings in the absence of the chair. In the absence of both the chair and the vice chair those nominated representatives present shall appoint one of their members present to act as chair for that particular meeting. The appointment of the chair and the vice Chair will be subject to biennial review, at which time the incumbent vice chair will normally be expected to assume the role of chair and a new vice-chair appointed, subject at all times to principles of good governance and best practice. Notwithstanding the above and subject to the agreement of Committee representatives, the term of the serving chair may be extended or any other representative appointed chair, depending on the circumstances then prevailing.

4.4 The quorum for meetings of the Committee shall be 5 nominated representatives of the Group Members. Notes of all meetings of the Committee shall be taken and copies of such notes circulated to Group Members as soon as practicable after each meeting.

4.5 Every effort will be made to ensure Committee business is conducted by consensus. In the event of issues arising at a meeting of the Committee that cannot be resolved by consensus, they shall be decided by a majority of votes and each nominated representative shall have one vote. In the case of an equality of votes the chairperson of the meeting shall have a casting vote.

4.6 The Committee may delegate any of its functions to sub-committees or to other persons as it considers appropriate for the task; provided that the delegation and the reasons therefore are recorded in writing.

4.7 The Committee will meet as often as necessary or desirable for the purposes of achieving the Objects at a convenient time and venue.

4.8 The Group Members shall at all times co-operate with each other and act in good faith to enable the Objects to be attained.

5 RESOURCING

5.1 Each of the Group Members will provide either a monetary contribution and/or some other contribution, e.g. services, premises, that shall be agreed by all the Group Members for the furtherance of the Objects of the Group in accordance with the work programme

referred to in clause 3.3(a). The contributions are to be provided promptly within the time frame agreed for contributions.

5.2 Milford Haven Port Authority shall receive all financial contributions by Group Members and shall keep such monies in a separate interest bearing bank account in trust for the Group.

5.3 Other contributions for the furtherance of the Objects of the Group, as identified in clause 5.1, may include (where applicable) the sharing of environmental surveillance or monitoring data, information or reports collected by members for their own purposes or to meet legal obligations, as identified in clause 3.5.

6 CONTRACTS

Under the terms of this Agreement, the members agree that:

6.1 Milford Haven Port Authority shall have the authority to, and be the sole Group member to let contracts with third parties on behalf of the Group in order to achieve the Group's Objects, including the appointment of professionals, advisers and consultants on behalf of the Group, subject to request from and prior approval of the Committee, and clause 6.3. MHPA shall only let contracts with third parties on behalf of the Group upon written instruction from Group compliant with the terms of clause 7.1. Responsibilities and liabilities arising from contracts will be owned by the Group; MHPA is the contract letting agent for administrative purposes.

6.2 Milford Haven Port Authority shall make payments on behalf of the Group in respect of contracts agreed at clause 6.1 but may not make any other payments or commitments on behalf of the Group without the prior approval of the Committee. Milford Haven Port Authority shall provide regular statements to the Committee in respect of such account.

6.3 No such contract shall be entered into unless there are sufficient funds available within the interest bearing bank account referred to in clause 5.2 to meet the obligations of Milford Haven Port Authority acting on behalf of the Group under the relevant contract.

6.4 Consultants and/or contractors will be engaged pursuant to MHPA's contract Terms and Conditions.

7 LIABILITY

7.1 Risk of liability will be minimised by:

a) agreeing to works and requesting contracts be let only when sufficient funds are available as set out in clause 6.3;

b) ensuring prospective contractors have appropriate levels of expertise, experience, competence and responsibility,

c) requiring contractors to carry appropriate liability insurance for damages arising as a result of fieldwork (prior to letting contracts (as stipulated in clause 6.1) and excluding liability arising from force majeure (as defined in clause 7.3);

d) requiring Contractors to submit an appropriate Risk Assessment and Method Statement prior to the commencement of works;

e) review and approval of Contractor's Risk Assessment and Method Statements by appropriate Group members, and / or delegated individual(s), most suited to the task, and maintaining written records of such reviews and approvals;

f) ensuring appropriate oversight of fieldwork and Contractors adherence to Risk Assessment and Method Statements by appropriate Group members, and / or delegated individual(s), most suited to the task, and maintaining written records of such oversight;

g) including a liability exclusion statement in all Group reports.

7.2 The costs or consequences of any legal action against the Group or against MHPA in connection with the activities of MHSWEG will be shared equally and the MHPA's risk as the party letting contracts will be mitigated through the measures set out in clause 7.1.

7.3 Consequently, as at the date of this Agreement the Group Members shall ensure that the Group has effected public liability insurance with a minimum limit of liability of £5,000,000 (five million pounds) in respect of each and every occurrence to cover the potential liability of the Group Members in relation to this Agreement and shall maintain such insurance until the date of termination of this Agreement.

7.4 The Group shall not be liable for losses, damages, costs and/or expenses incurred as a result of force majeure which shall include without limitation any failure or delay attributable to facts beyond the control of the Group such as wars, hostilities, boycotts, embargoes, public disorders, sabotage, strikes, lockouts, floods, fires or acts of God.

8 INTELLECTUAL PROPERTY RIGHTS

8.1 All IP Rights developed or generated by the Group in pursuance of the Objects shall be owned by the Group Members jointly.

8.2 Any Group member that withdraws from the Agreement will retain joint ownership of Group IP Rights developed or generated during the period of their membership of the Group.

8.3 Any Group Member shall be entitled to use any IP Rights free of charge provided that any such use shall not compromise the Objects of the Group and provided further that if any Group Member wishes to license or authorise any third party to use or exploit any IP Rights owned by the Group, the Group Members shall jointly agree and grant such a licence to such third party and such third party shall be required to pay a licence fee.

8.4 All costs and expenses and all receipts in respect of any IP Rights owned jointly by the Group Members shall be shared equally by the Group Members.

8.5 Each Group Member shall retain all rights to Intellectual Property in all materials, information etc. contributed by that Group Member as stipulated in clause 3.5.

9 TERM AND TERMINATION

9.1 The provisions of this Agreement shall come into force on the date stated above.

9.2 A Group Member may at any time terminate its participation in respect of this Agreement subject to having given notice in writing to the Chairperson with no right of return of financial contributions.

9.3 In the event that any Group Member is in breach of this Agreement which they fail to remedy within 14 days of written request by the Committee then such Group Member's involvement in the Group may be terminated by notice given to them by the Committee at any time following expiry of the said period of 14 days, with no right of return of financial contributions.

9.4 Subject to clauses 8.2 and 8.3 this Agreement will terminate on completion of the Objects stated in clause 3.

9.5 Upon termination of this Agreement the Group shall either be:

a) reconstituted as appropriate to fulfil the Objects of the Group; or

b) terminated forthwith and the Group Members shall take such further steps as may be necessary in order to wind up the Group in a fair and reasonable manner.

The financial assets of the Group at winding up should be distributed or shared pro rata to the direct financial contributions by Group Members.

9.6 If a Group Member's participation in the Group is terminated in accordance with clause 8.2 or 8.3 the provisions of clauses 6.1 to 6.3 shall no longer apply in respect of that Group Member.

10 THIRD PARTIES

10.1 Nothing in this Agreement shall create any rights for third parties under the Contracts (Rights of Third Parties) Act 1999. No variation to this Agreement and no supplemental or ancillary agreement to this Agreement shall create any such rights unless expressly so stated in any such agreement by the Group Members to this Agreement. This does not affect any right or remedy of a third party that exists or is available apart from that Act.

11 NO BINDING PARTNERSHIP

11.1 Nothing in this Agreement shall be construed as establishing or implying any legally binding partnership between the Group Members.

12 SUCCESSORS

12.1 References in this Agreement to the Group Members shall include their respective heirs, successors in title, permitted assigns and personal representatives.

13 ASSIGNMENT

13.1 No Group Member should assign its interests in this Agreement without prior approval of the Committee (not to be unreasonably withheld) except that no such approval is required for an assignment to a company in the same group as the Group Member.

14 GENERAL

14.1 Provisions which by their terms or intent are to survive termination of this Agreement will do so.

14.2 No amendment or variation of this Agreement will be valid unless agreed in writing by an authorised signatory of each party.

14.3 Unless otherwise expressly agreed, no delay, act or omission by either party in exercising any right or remedy will be deemed a waiver of that, or any other, right or remedy.

14.4 Each party will do all further acts and execute all further documents necessary to give effect to this Agreement.

15 INFORMATION SHARING AND DATA PROTECTION

15.1 Several members of the Group (public bodies) are subject to the Freedom of Information (FoI) Act and Environmental Information Regulations (EIR) whilst others (industry bodies) are not. Whilst circumstances under which valid FoI and/or EIR requests may

be submitted to the Group are anticipated to be limited since the Group operates transparently, places all outputs in public domain, and commercial tender assessments and contract details are protected by confidentiality exemptions, every effort will be made to meet any such request, taking into account advice and guidance from the Information Commissioner's Office and the obligations on public bodies.

15.2 The Group will comply with the Data Protection Act and adhere to the data protection principles to ensure personal data is safeguarded.

16 REVIEW

This Agreement will be subject to review and reaffirmation at five yearly intervals from the date of the Agreement.

17 COUNTERPARTS

This Agreement may be executed in any number of counterparts, each of which is an original and which together have the same effect as if each Group Member had signed the same document.

Appendix 3: Chronological list of MHWEMSG / MHWESG[2] reports

1992

Hobbs, G and Morgan, C I (eds.) (1992). *A review of the current state of environmental knowledge of the Milford Haven Waterway*. Report from Oil Pollution Research Unit; xi &140pp

Hobbs, G and Morgan, C I (eds.) (1992). *A review of the current state of environmental knowledge of the Milford Haven Waterway; Executive Summary*. Report from Oil Pollution Research Unit, 12pp

MHWEMSG (1992). *Report of the Milford Haven Waterway Environmental Monitoring Steering Group 1992*. 6pp

1993

Hodges, J E (1993). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey: report for 1993.* Report from Pembrokeshire Coast National Park Authority, 8pp + appendices

1994

Ellis, R & Poole, A (1994). *Cleddau Estuary wader and wildfowl counts 1993 – 94. 20* pp + appendices

Hodges, J E (1995). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey: report for 1995.* Report from Pembrokeshire Coast National Park Authority,8pp + appendices

Levell, D, Smith, J and Hobbs, G (1994). *Milford Haven macrobenthic survey October 1993*. Report from Oil Pollution Research Unit; xii, 26pp + figures, tables & data appendices.

MHWEMSG (1994). *Report of the Milford Haven Waterway Environmental Monitoring Steering Group 1993/94*. 20pp

Smith, J and Hobbs, G (1994). *Metal concentrations in Milford Haven sea bed sediments - data storage, analysis and initial interpretation*. Report from Oil Pollution Research Unit; v, 8pp + tables & maps

1995

Hodges, J E (1995). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey: report for 1995.* Report from Pembrokeshire Coast National Park Authority 10pp + appendices

Howe, M (1995). *Monitoring of eelgrass populations in the Milford Haven waterway and Daugleddau Estuary*. Report from Pembrokeshire Coast National Park Authority; 7pp

MHWEMSG (1995). *Report of the Milford Haven Waterway Environmental Monitoring Steering Group 1994/95.* 19pp

Poole, A & Ellis, R (1995). *Cleddau Estuary including Milford Haven Waterway: wildfowl and wader counts 1994 – 95.* 30pp

Rostron, D M (1995). *The macrobenthos of the foreshore soft sediments of Milford Haven, 1994*. Report from SubSea Survey; 2 vols, 17pp + maps, figures & data appendices

[2] The Group changed its name in 2000

1996

Hodges, J E (1996). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey: report for 1996.* Report from Pembrokeshire Coast National Park Authority, 8pp + appendices

MHWEMSG (1996). *Report of the Milford Haven Waterway Environmental Monitoring Steering Group 1995/96.* 14pp

Poole, A (1996). *Milford Haven and Cleddau Estuary wetland bird survey 1995-96*. 18pp

1997

Hodges, J E (1997). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey: report for 1997.* Report from Pembrokeshire Coast National Park Authority. 10pp + tables & appendices

MHWEMSG (1997). *Report of the Milford Haven Waterway Environmental Monitoring Steering Group 1996/97.* 36pp

Moore, J J (1997). *Rocky shore transect monitoring in Milford Haven, October 1995.* Report from Oil Pollution Research Unit. OPRU Report No OPRU/14/96. 36pp + appendices

Poole, A (1997). *Milford Haven Waterway and Cleddau Estuary bird survey 1996-97*. 13pp + appendices

1998

Hodges, J E (1998). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey – report for 1998.* Report from Pembrokeshire Coast National Park Authority. 9pp + tables & appendices

Munro, C (1999). *Monitoring of the rocky sub-littoral of Milford Haven: May-July 1998.* Report from Marine Biological Surveys. v, 38pp + appendices, photographs and videorecording

Poole, A (1998). *Milford Haven Waterway and Cleddau Estuary bird survey 1997-98*. 12pp + appendices

1999

Hodges, J E (1999). *Daugleddau Estuary and Milford Haven Waterway annual shelduck survey – report for 1999.* Report from Pembrokeshire Coast National Park Authority. 8pp + tables & appendices

Kitts, H (1999). *Quantification of inputs to Milford Haven*. Report from Hyder Ltd. 29pp + tables & appendices

MHWEMSG (1999). *Report of the Milford Haven Waterway Environmental Monitoring Steering Group 1997 - 1999*. 25pp

Poole, A (1999). *Milford Haven Waterway and Cleddau Estuary Bird Survey 1998-99*. 13pp + appendices

Posford Duvivier (2000). *A survey of subtidal Zostera beds in Milford Haven*. 36pp + appendices

2000

Bent, E J (2000). *A review of environmental studies in Milford Haven Waterway 1992 – 2000*. iv, 65 pp + tables & maps

Hodges, J E (2000). *Daugleddau Estuary and Milford Haven Waterway annual shelduck Survey – Report for 2000.* Report from Pembrokeshire Coast National Park Authority. 10pp + tables + appendices

MHWESG (2000). *Milford Haven Waterway Environmental Surveillance Group Annual Report 1999 - 2000*. 20pp & appendices

Poole, A (2000). *Milford Haven waterway and Cleddau Estuary Bird Survey 1999-2000*. 15pp + appendices

2001

Hodges, J E (2001). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2001.* Report from Pembrokeshire Coast National Park Authority. 8pp + appendices

Poole, A (2001). *Milford Haven Waterway and Cleddau Estuary bird survey 2000-01*. 14pp + appendices

2002

Hodges, J E (2002). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2002.* Report from Pembrokeshire Coast National Park Authority. 8pp + appendices

Poole, A (2002). *Milford Haven Waterway and Cleddau Estuary bird survey 2001-02.* 12pp + appendices

2003

Bent, E J (2003). *Milford Haven Waterway review of work programme 2000 – 2010*. 32pp

Hodges, J E (2004). *Daugleddau Estuary and Milford Haven waterway surveillance of summer shelduck populations: report for 2003.* Report from Pembrokeshire Coast National Park Authority. 9pp + appendices

Poole, A (2003). *Milford Haven Waterway and Cleddau Estuary bird survey 2002-03.* 16pp + appendices

Prosser, M V & Wallace H L (2003). *Milford Haven salt-marsh survey 2002.* Report from Ecological Surveys (Bangor). 2 vols. 58pp + appendices, photographs & maps

2004

Hodges, J E (2004). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2004.* Report from Pembrokeshire Coast National Park Authority. 7pp + appendices

Haycock, A (2004). *Milford Haven Waterway and Cleddau Estuary Bird Survey 2003-04.* 14pp + appendices

2005

Atkins (2005). *Development of an Inputs Budget for Milford Haven Waterway.* 68pp + cd database & GIS data

Hodges, J E (2005). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2005.* Report from Pembrokeshire Coast National Park Authority. 8pp + appendices

Haycock, A (2005). *Milford Haven Waterway and Cleddau Estuary Bird Survey 2004-05. 7*pp + appendices

2006

Hodges, J E (2006). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2005.* Report from Pembrokeshire Coast National Park Authority. 8pp + appendices

Haycock, A (2006). *Milford Haven Waterway and Cleddau Estuary Bird Survey 2004-05. 7*pp + appendices

Warwick, R (2006). *Review of benthic and intertidal sediment macrofauna data and development of a surveillance programme*. 105pp + electronic data annex

2007

Hodges, J E (2007). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2006.* Report from Pembrokeshire Coast National Park Authority. 8pp + appendices

2008

Haycock, A (2008). *Wildfowl and wader counts on the Milford Haven Waterway 2006-07* 20pp

Haycock, A (2008). *A review of the status of wetland birds in the Milford Haven waterway and Daugleddau estuary*. A report to the Milford Haven Waterway Environmental Surveillance Group. 122pp

Hodges, J E (2008). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2008*. Report from Pembrokeshire Coast National Park Authority. 26pp + appendices

2009

Haycock, A (2009). *Wildfowl and wader counts on the Milford Haven Waterway 2007-08* 20pp

Hodges, J E (2009). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2009*. Report from Pembrokeshire Coast National Park Authority. 9pp + appendices

Langston, W J, O'Hara, S, Imamura M & Pope, N D (2009) *Bioaccumulation surveillance in Milford Haven Waterway 2007-2008*. Report to the Milford Haven Waterway Environmental Surveillance Group from the Marine Biological Association Plymouth. 66pp + appendices

Little, D I (2009) *Sediment Contaminants & Transport Review*. A report to the Milford Haven Waterway Environmental Surveillance Group. 368pp + appendices

2010

Haycock A (2010). *Wildfowl and wader counts on the Milford Haven Waterway, 2009-10*. A report to the Milford Haven Waterway Environmental Surveillance Group. 24pp

Hodges, J E (2010). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2010.* Report from Pembrokeshire Coast National Park Authority. 8 pp + appendices

Mieszkowska, N. (2011). *Reestablishment of intertidal rocky surveillance*. A report to the MHWESG from the Marine Biological Association on ot the UK. 54pp + appendices.

2011

Haycock A (2011). *Wildfowl and wader counts on the Milford Haven Waterway, 2010-11*. A report to the Milford Haven Waterway Environmental Surveillance Group. 24pp

Hodges, J E (2011). Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2011. Report from Pembrokeshire Coast National Park Authority. 8pp + appendices

2012

Fugro-ERT (2012). *Investigation into the source of hydrocarbons present in sediment samples from Milford Haven waterway*. Report to the Milford Haven Waterway Environmental Surveillance Group from the Fugro-ERT (Fugro Geoconsulting). v&40pp + appendices

Hodges, J E (2012). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2012*. Report from Pembrokeshire Coast National Park Authority. 9pp + appendices

Langston, W J, O'Hara, S, Davey, M, Shortridge, E, Pope, N D, Harino, & Vane, C H. (2012) *Bioaccumulation surveillance in Milford Haven Waterway Phase II (2010)* Report to the MHWESG from the Marine Biological Association UK. 85pp + appendices

2013

Germano & Associates (2013). *Sediment-Profile Imaging Survey of Milford Haven Waterway, Wales, UK - May 2012*. Report to the Milford Haven Waterway Environmental Surveillance Group from Germano & Associates, Inc., Seattle, Washington, USA. vii&34pp + tables, figures and appendices

Haycock, A (2013). *A review of the status of wetland birds in the Milford Haven Waterway and Daugleddau Estuary 2013* A report to the Milford Haven Waterway Environmental Surveillance Group. 123pp

Hodges, J E (2013). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2013*. Report from Pembrokeshire Coast National Park Authority. 9pp + appendices

2014

Galperin, Y & Little, D I (2014). *Forensic Evaluation Of Milford Haven Sediment Hydrocarbon Contamination: Supplemental Report*. Report to Milford Haven Waterway Environmental Surveillance Group from EGC Consulting California USA & David I. Little; 60 pp.

Haycock, A (2014). *A review of the status of wetland birds in the Milford Haven Waterway and Daugleddau Estuary 2013-14*. A report to the Milford Haven Waterway Environmental Surveillance Group; 24 pp.

Hodges, J E (2014). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2014*. Report from Pembrokeshire Coast National Park Authority. 11pp + appendices

Morrell, S (2014). *Rocky Shore Surveillance 2013*. Report to Milford Haven Waterway Environmental Surveillance Group from the Field Studies Council Dale Fort Field Centre; 50 pp.

Little, D I & Galperin, Y, 2014. *Milford Haven sediment hydrocarbon and metals contamination: supplemental report on recent contaminant trends*. Report to Milford Haven Waterway Environmental Surveillance Group

2015

Haycock, A (2015). *A review of the status of wetland birds in the Milford Haven Waterway and Daugleddau Estuary 2014-15*. Report to the Milford Haven Waterway Environmental Surveillance Group.

Hodges, J E (2015). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2015*. Report to MHWESG from Pembrokeshire Coast National Park Authority.

Rumney H S, K Potter, P Mellor & P Bersuder (2015). *Analysis of Sediment Contaminants in Milford Haven Waterway Total Hydrocarbon (THC) concentration in sediments*. Data report to MHWESG from Centre for Environment, Fisheries & Aquaculture Science, Lowestoft.

2016

Clough, R (2016). *Determination of Multiple Analytes in Sediment Samples*. Data report to MHWESG from Analytical Research facility, University of Plymouth.

Haycock, A (2016). *Review of the status of wetland birds in the Milford Haven Waterway and Daugleddau Estuary 2016*. Report to the Milford Haven Waterway Environmental Surveillance Group.

Hodges, J E (2016). *Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2016.* Report to the Milford Haven Waterway Environmental Surveillance Group

Warwick, Richard M (2016). *Milford Haven Waterway sediment macrobenthos data analysis & review 2008-15*. Report to the Milford Haven Waterway Environmental Surveillance Group, Plymouth Marine Laboratory.

2017

Archer-Thomson, J H S and Morrell, S L (2018). *Milford Haven Waterway rockshore surveillance 2017.* Report to the Milford Haven Waterway Environmental Surveillance Group.

Haycock A (2017). *Wildfowl and wader counts on the Milford Haven Waterway, 2016-17.* A report to the Milford Haven Waterway Environmental Surveillance Group.

Hodges, J E (2017). Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2017. Report to the Milford Haven Waterway Environmental Surveillance Group.

Little, D I (2017). *Sediment contaminant concentrations in Milford Haven waterway: data conversion and timeline*. Report to the Milford Haven Waterway Environmental Surveillance Group.

Unsworth, R K F, Bertelli, C M, Robinson, M, Mendzil, A (2017). Status review and surveillance recommendations for seagrass (Zostera species) in Milford Haven Waterway. Report to the Milford Haven Waterway Environmental Surveillance Group.

2018

Haycock A (2018). Wildfowl and wader counts on the Milford Haven Waterway, 2017-18. A report to the Milford Haven Waterway Environmental Surveillance Group.

Hodges, J E (2018). Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2018. Report to the Milford Haven Waterway Environmental Surveillance Group.

Birkhead, T R (2018). The Value of Long-term Monitoring and Long-term Research. A report to the Milford Haven Waterway Environmental Surveillance Group.

2019

Haycock A (2019). A review of the status of wetland birds in the Milford Haven Waterway and Daugleddau Estuary, 2019. A report to the Milford Haven Waterway Environmental Surveillance Group.

Hodges, J E (2019). Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2019. Report to the Milford Haven Waterway Environmental Surveillance Group.

www.mhwesg.org.uk/ website for the Milford Haven Waterway Environmental Surveillance Group

2020

Archer-Thomson, J H S and Morrell, S L (2020). Milford Haven Waterway Rocky Shore Surveillance, 2020. A report to the Milford Haven Waterway Environmental Surveillance Group.

Green, R M W, Burton, N H K and Cook, A S C P (2020). A review of shelduck data (1992-2019) for the Milford Haven Waterway, Pembrokeshire. A report to the Milford Haven Waterway Environmental Surveillance Group.

Haycock, A (2020). Wildfowl and wader counts on the Milford Haven Waterway, 2019-20. A report to the Milford Haven Waterway Environmental Surveillance Group.

Hodges, J E (2020). Daugleddau Estuary and Milford Haven Waterway surveillance of summer shelduck populations: report for 2020. Report to the Milford Haven Waterway Environmental Surveillance Group.