



MILFORD HAVEN WATERWAY
ENVIRONMENTAL SURVEILLANCE GROUP

GRŴP CADW GOLWG AMGYLCHEDDOL
AR DDYFRFFORDD ABERDAUGLEDDAU



Annual Report 2017



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COVER IMAGES

Front cover: Natural Resources Wales staff sampling with a Day Grab during macrobenthic survey.

Rear cover: Average size of broods 1991 – 2017 from the annual survey of summer shelduck populations (Hodges, 2017).

MILFORD HAVEN WATERWAY ENVIRONMENTAL SURVEILLANCE GROUP

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Port of Milford Haven
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Milford Haven Waterway Environmental Surveillance Group Report 2017

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Chair's Foreword

There is a rapidly growing global realisation that 'all is not well with the world'. The impacts of global warming and climate change are reported world-wide. And as a gardener in Pembrokeshire, I also see evidence of climate change locally, and am having to adapt my gardening ways!

As if climate change wasn't enough, human activity has also resulted in further environmental issues such as pollution, loss of natural resources and biodiversity, acidification and over-population.

Amongst these alarming facts where does the MHWESG fit in? What are we doing to contribute to the greater good?

If I could ask you to take a look at Appendix 3, you will see an extensive list of surveillance related research that the MHWESG has commissioned since 1992, some making its way into peer reviewed academic publications. This work contributes to a better understanding of the human impact on our marine environment, and although the work of the group focusses tightly on the Milford Haven Waterway, this knowledge makes its way into the wider environmental context when amalgamated with UK or even global studies.

Following on from our revamp of the Memorandum of Understanding, which took most of 2016 to get right, we are now embarking on another round of sponsorship of surveillance-related projects, many of which will continue from already established long-term studies or will start in earnest through 2018. The continued collaboration and excellent working relationships between industry representatives and local regulatory bodies, make this group a pleasure to chair. The only challenge really is deciding what to sponsor, as there is always more on the list than we can afford! I must also add that without the generous contributions from the organisations that make up the group, none of this would happen. So long may it continue.

Over the next few pages are summaries of the work in 2017 - I hope you find it interesting and worthwhile.

Finally, 2018 will be our 25th anniversary and we plan to celebrate it with an event where we showcase some of our work. I do hope you or a representative can attend!

Paul Howells

Dragon LNG Ltd

Chair

Rhagair y Cadeirydd

Mae ymwybyddiaeth 'nad yw popeth yn iawn gyda'r byd' yn tyfu'n gyflym ledled ein planed. Clywn adroddiadau o bob cwr o'r ddaear am gynhesu byd-eang a newid yn yr hinsawdd. Fel garddwr yma yn Sir Benfro, rwyf innau'n sylwi ar dystiolaeth o newid yn yr hinsawdd leol, a hyd yn oed yn gorfod addasu fy null o arddio!

Fel pe na bai'r newid yn yr hinsawdd yn ddigon, mae gweithgarwch dynol wedi creu problemau amgylcheddol pellach, megis llygredd, colli adnoddau naturiol a bioamrywiaeth, asideiddio a gorboblogi.

Yng nghanol yr holl ffeithiau brawychus hyn, beth yw swyddogaeth Grŵp Goruchwylio Amgylcheddol Dyfrffordd Aberdaugleddau? Beth yw ein cyfraniad ni i les y mwyafrif?

Pe gofynnwn ichi edrych ar Atodiad 3, byddech yn gweld rhestr faith o'r adroddiadau ymchwil gwyliadwriaethol a gomisiynwyd gan y Grŵp er 1992, nifer ohonynt wedi ymdreiddio i'r cyhoeddiadau academaidd a adolygir gan gymheiriaid. Mae'r gwaith hwn yn cyfrannu at well dealltwriaeth o effaith dynoliaeth ar ein hamgylchedd morol – ac er bod gwaith y Grŵp yn canolbwyntio'n gaeth ar Ddyfrffordd Aberdaugleddau, mae'r wybodaeth a enillir yn treiddio i'r cyd-destun amgylcheddol ehangach, ac yn ategu astudiaethau eraill yn y Deyrnas Unedig a thu hwnt.

Yn dilyn ein hailwampiad o'r Memorandwm Dealltwriaeth, a gymerodd ran helaeth o 2016 i'w berffeithio, rydym bellach yn dechrau noddi rownd arall o brosiectau gwyliadwriaethol; bydd llawer o'r rheiny'n barhad o astudiaethau hirdymor a sefydlwyd eisoes, ac eiriol yn dechrau o ddifrif yn ystod 2018. Mae'r cydweithio parhaus, a'r berthynas waith ragorol â chynrychiolwyr diwydiannau a chyrrff rheoleiddio lleol, yn gwneud cadeirio'r Grŵp hwn yn bleser. Yr unig wir her yw penderfynu pa bethau i'w noddi, gan fod mwy ar y rhestr bob amser nag y gallwn eu fforddio! Dylwn ychwanegu hefyd na fyddai dim o'r gwaith hwn yn digwydd heb y cyfraniadau hael gan y cyrrff sy'n aelodau o'r Grŵp. Hir y parhaed hynny.

Ar yr ychydig dudalennau nesaf rhoddir crynodebau o'r gwaith a wnaed yn 2017. Gobeithiaf y byddwch yn eu cael yn ddiddorol a gwerthfawr.

Yn olaf, byddwn yn dathlu pen-blwydd y Grŵp yn 25 oed yn 2018, gyda digwyddiad a fydd yn arddangos rhywfaint o'n gwaith. Gobeithiaf yn fawr y gellwch chi neu'ch cynrychiolydd fod yn bresennol!

Paul Howells

Dragon LNG Ltd

Cadeirydd

1. Introduction

This is the seventeenth annual report of the Milford Haven Waterway Environmental Surveillance Group (formerly the Milford Haven Waterway Environmental Monitoring Steering Group). It covers the period January to December 2017.

A detailed history of the Group and its outputs since its establishment in 1991 was included in the 2013 report and readers wishing to know more about the development of the Group and projects completed up to the end of 2013 are referred to that report which is available as a PDF document on request.

The Annual Report for 2015-2016 included a detailed technical summary of the work involved to develop a timeline for sediment contaminant concentrations in the Milford Haven waterway (Little, 2017). Not surprisingly, this comprehensive assimilation of past and present methods and results for sediment contamination in the Milford Haven waterway resulted in an equally comprehensive and insightful report. The Group made a decision that it was important to publicise this item of work as the key messages are relevant to other long-term surveillance programmes, and to interpretation of datasets generally. To that end, the Group commissioned the production of a non-technical summary, and this was used as the basis for the summary produced in 2.1.

A repeat of rocky shore surveillance, previously carried out in 2010 and 2013, was carried out in 2017 and a summary can be found in section 2.2. Similarly, a repeat of subtidal sediment macrobenthic sampling, previously carried out 2008, 2010 and 2015, was repeated in 2017 and is summarised in section 2.3.

The well-established annual wetland bird surveillance projects (wildfowl and wader counts and the annual survey of summer shelduck populations) were continued in 2017 and are summarised in sections 2.4 and 2.5.

Finally, continuing the recent series of guest contributions of surveillance-related work relevant to the Milford Haven waterway, section 3.1 includes a summary of a report scoping the regeneration of the native oyster in the waterway.

The full reports for all MHWESG commissioned work are available from mhwesg@gmail.com.

2. Group activity 2017

2.1 *Sediment contaminant concentrations in Milford Haven waterway: data conversion and timeline. Non tech summary, key messages and recommendations*

SUMMARY

The Milford Haven Waterway (MHW) has been the subject of surveys to determine concentrations of sediment contaminants for over 40 years. Laboratory analytical methods have changed in this time, making it difficult to compare current sediment contaminant concentrations in the MHW with those recorded in the past. This project inter-calibrated past and present methods for total hydrocarbon concentration (THC) and trace metals by subjecting paired sediment samples to old and new laboratory methods. The converted older data created a reliable baseline for future comparison, and also a timeline for contaminant input. This improves our understanding of the effects of oil spills, other contaminant inputs, and marine engineering works in the MHW.

Long-term trends in sediment contaminants since the late 18th century showed that THC decreased after both World Wars, and again after peak oil output in 1974. High THC also occurred mainly on the waterway's shorelines after some, but not all, oil spills. There were five significant increases and five significant decreases in mean THC in the MHW since the late 1970s, which suggested broadly stable THC in sediments. Some recent increases in THC seemed to be anomalous in the absence of recent large oil spills, and in light of improvements in effluent quality and of generally reduced economic activity since the 2008 financial crisis. This anomaly has arisen from disturbance and redistribution of historically-contaminated sediment during several years of dredging and construction, peaking in 2006.

The mean trace metals concentrations showed 22 significant increases and 27 significant decreases in the same period. Unlike the above fluctuations in THC which cancelled each other out, many trace metal trends noticeably decreased. This was also observed spatially, for example the decrease in lead concentrations through time in the innermost reaches of the waterway. Closure of sewage outfalls or investment in effluent treatment, reduction in lead domestic plumbing, and elimination of tetraethyl lead in petrol were all factors. Other trace metals showed similar concentrations since the late 18th century except after major dredging and engineering works, such as those peaking in 2006.

The chronology of contaminants in the waterway back to the 18th century was enabled by the sampling of deep sediment cores in the 1980s. These cores were dated using radionuclide decay rates, and allowed contaminant timelines to be traced back over centuries. They also provided the only previous data on rare earth elements (REE) in the waterway's sediments. REE are emerging contaminants from waste streams of electronics and renewables industries that have recently become established in the catchment. Two REE concentrations decreased, but overall there were no major changes in REE over 30 years.

Data must inspire confidence among the end users. Therefore for the Milford Haven Waterway Environmental Surveillance Group to construct an accurate timeline of sediment contaminant history in the MHW, it was necessary to undertake this data conversion exercise. Ultimately, this allowed for a more meaningful interpretation of contaminant trends to date, and in the future, which in turn will strengthen the rationale for decision making.

Key messages and recommendations:

- The usefulness of deep core-profiling for establishing contaminant timelines was confirmed, and should be repeated to include additional contaminants not previously analysed in the waterway, e.g. persistent pesticides, fire retardants and explosives.
- Monitoring data collected over long periods are potentially of great value in understanding estuarine processes, and thus in sustaining environmental quality in the waterway. This current study has addressed the inevitable generic issue of evolving laboratory methods over long term surveillance periods. These long term programmes must facilitate comparability of results over time, and it is therefore essential that before a newly accredited or revised method be adopted, an inter-calibration exercise is carried out. This had not been consistently undertaken by those commissioning monitoring studies over the years when methods changed.
- The value of monitoring can also only be fully realised when data is archived properly. Archiving of results needs to embed additional information on field and laboratory methods, as well as other relevant information such as context, constraints etc. Commissioning bodies in the future need to ensure that sufficient documentation is irrevocably embedded with tables of results. Otherwise, constraints and specific methods employed will be forgotten long after the original purpose of the project has been served.
- Awareness of field and laboratory methods is particularly important when datasets are used to develop baselines, trends or undertake Environmental Impact Assessment predictions. This report found that unreliable past data was still being used because issues surrounding the laboratory method used were not understood / recorded. Laboratory or method accreditation does not remove the need for vigilance.

2.2 Milford Haven Rocky Shore Surveillance 2017

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 9th and 25th of August 2017. This repeated the work carried out by the Marine Biological Association of the UK in 2010 and Field Studies Council in 2013 and used the same methodology.

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

There was close agreement in the overall community data between 2013 and 2017. This suggested a generally stable situation between the two surveys and underlined the benefits of having the same personnel carry out the work.

The pattern of high biodiversity at the open coast sites (Dale Point and Great Castle Head) decreasing up the Haven continued from the 2013 survey. 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.

Barnacle percentage cover results were similar to those of 2013. *Semibalanus balanoides* dominated on the open coast, *Austrominius modestus* dominated in the upper reaches of the Haven. This was in line with expectation as *A. modestus* is tolerant of salinity fluctuations. 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 Haven. *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 2013 survey. 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.

For *Ascophyllum nodosum* at Coshaston Folly and Sawdern Point there was evidence that individuals had survived from the previous survey resulting in higher vesicle counts. At Llanreath the unusual frequency distribution of vesicle numbers was maintained from the previous survey. This suggests that the factors causing this are consistent with those present in 2013.

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 Haven (monitored by the present authors) have shown increases in recent years. Size data showed no clear, overriding pattern except in that increases or decreases in trochid size were in the same direction at each of the sites for each of the two species measured.

Recommendations include annual surveys, some changes in methodology and consistency in personnel.

2.3 Milford Haven waterway sediment macrobenthic sampling 2017

In 2006, the MHWESG commissioned a review of past sediment macrofauna data in the Milford Haven Waterway, and this resulted in a recommendation for the establishment of a subtidal macrobenthic surveillance programme. The Group initiated such a surveillance programme in 2008 at 8 stations (Figure 1), and this was repeated in 2010 and 2015.

In 2016, the Group commissioned an analysis and examination of trends in the 2008, 2010 and 2015 datasets. This analysis explored the relationships between macroinvertebrate communities and physicochemical variables throughout the waterway. This allowed comparisons to be made between datasets to assess increase (or decrease) in stress or impacts, change in functional groups, sensitive species etc. This report was published in 2017 (Warwick, 2017), and is summarised in the Group's Annual Report 2015-2016.

In September 2017, the Group continued this surveillance programme by collecting sediment samples at the same 8 stations in the Milford Haven Waterway. Natural Resources Wales provided personnel and use of the NRW boat 'Skalmey' as a sampling platform. The macrofauna of these sediment samples have been analysed, and results are with the Group. These results will form part of a future review of the macrobenthic fauna of the Milford Haven waterway once sufficient repeat sampling events have occurred.

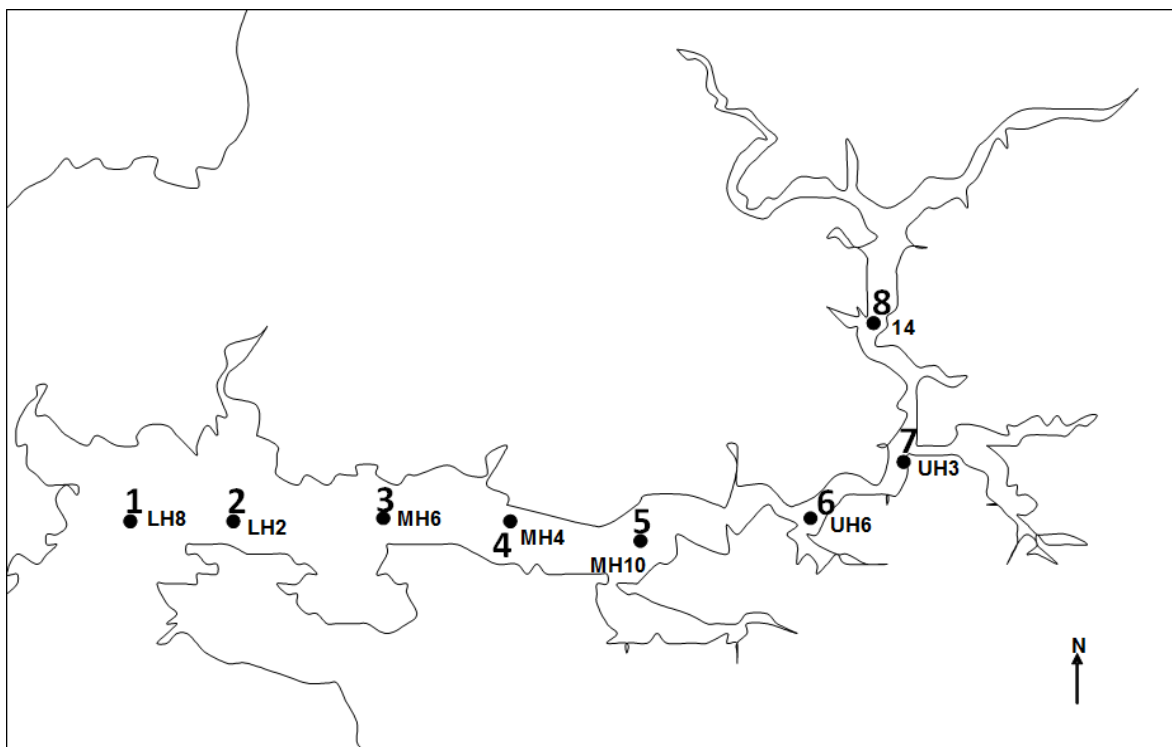


Fig. 1. MHWESG sampling stations in Milford Haven showing new (1-8) and original names.

2.4 Daugleddau Estuary and Milford Haven Waterway: annual surveillance of summer shelduck populations 2017

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 carried out between 1991 and 2016. The summer shelduck survey was repeated in 2017 as part of a co-ordinated programme of environmental surveillance work in the estuary system. The aims, objectives and methods used together with the data obtained are described in this report.

The results indicate that the number of broods of ducklings seen on the water in 2017 was (in terms of the number of broods seen during the survey) the poorest year since 2013. The data suggest that following a brief period of recovery, the long-term decline of the breeding population has resumed. The average brood size recorded in June 2017 was however, the highest since 1991 and suggested good survival of ducklings at least as far as getting onto the water from their nest sites. By the second part of the survey in late July, the average brood size had only dropped to 7.8 young per pair, indicating relatively good survival of young once they were on the water.

As in previous years, predation (by avian and/or mammalian predators) is likely to have been a significant factor affecting the number and size of broods recorded in the estuary system in 2017. Adverse weather conditions in early and late June (notably heavy and persistent rain) may have affected any late clutches of eggs or very small ducklings that may still have been in the nest although it is unlikely to have been a significant factor affecting the survival of ducklings that were already on the water. Disturbance (on land and/or on the water) may have affected breeding success and subsequent survival of ducklings, although there is little evidence on which an assessment of the significance of this factor can be based. Other factors such as thick "mattresses" of green macro-algae (linked to high levels of nutrients in the estuary system) deposited on mudflats by falling tides and the redistribution of (contaminated) sediments as a result of anthropogenic activities may have had localised effects on access to and/or the quality of foraging habitat, hence on fitness and survival of adult and young shelducks.

Since the mid-1990s, there has been a downward trend in the numbers of shelducks over-wintering in the UK. This national trend has been mirrored by a decline in the numbers of shelducks over-wintering in the estuary system which continued in the 2016/17 winter. This downward trend is likely to be linked to factors such as the increasing tendency for birds to "short-stop" in mainland Europe in response to the recent trend towards mild winters across Western Europe, and possibly to changes in the annual moult grounds. As a consequence of the decline in the numbers of shelducks electing to over-winter in the estuary system, fewer are remaining to breed. This is likely to have been a significant contributory factor to the decline in the numbers of broods seen during the survey. Local environmental factors are however, more likely to have influenced the declines in brood sizes that have been observed up to and including 2016.

Data collected for other wetland birds once again underlined the importance of the estuary system during migration, especially for species such as curlew.

The report concludes with a recommendation for the continuation of the annual surveillance of the summer shelduck population in the estuary system as part of the Milford Haven Waterway Environmental Surveillance Group's annual work programme. Potential lines of enquiry into the continued decline in the numbers and size of broods are also suggested and, in addition, it is recommended that actions to address the high nutrient status of the waters of the estuary system be urgently identified and implemented.

2.5 Wildfowl and water counts in the Milford Haven Waterway 2017-18

Annie Haycock, Pembrokeshire WeBS Coordinator

Executive Summary

The Wetland Bird Survey was carried out on the Cleddau Estuary system between September 2017 and March 2018 with additional counts for June and July 2017 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 26,556 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 27,435. This peak count is about average for the site, in winters when there is no great influx of lapwing and golden plover.

The levels of "National Importance" for many water birds were revised in 2011, and only four species now qualify (based on a five-year mean): wigeon (max. 8703 in November), teal (max 1812 in December), greenshank (max 39 in October), and Little Egret (68 in October).

Curlew (1244 in July) were at their lowest level since 1999-2000, a reflection of the decline recorded across their range.

Dunlin (3214 in December) reached the qualifying level in 2017-18 but were short based on the 5-year average. Shelduck (449 in March) is still well below the qualifying level.

Wigeon numbers seem to have recovered from the low counts in 2013-15, reaching their highest count since 2005-06. The peak count was in November, with numbers remaining higher than average in December. The reason for these changes is not yet known, however the Milford Haven Waterway is not the only site to have experienced temporary reductions in numbers in recent years.

The total number of birds recorded in September and October was lower than the average of the past twenty years, except in November when the influx of wigeon boosted the total. Numbers remained similar to or just above average for the rest of the winter. However, there were considerable differences from month to month, and from species to species. This was particularly noticeable in March with very cold and windy weather conditions (the 'Beast from the East') caused many birds, particularly shelduck and teal, to pause in their migration.

Comparison of counts with the national report for 2016-17 (the most recent that is available) show that for most species, the local population trends are similar to those experienced nationally.

3. Other activity in the waterway

3.1 Milford Haven Native Oyster Regeneration Project - Stage One (current status and practicalities)

Dr. Philine S. E. zu Ermgassen. A report commissioned by West Wales Shellfishermans Association Ltd, supported by the Milford Haven Native Oyster Regeneration Management Group. May 2017

Executive Summary

The Milford Haven Waterway, which lies within the Pembrokeshire Marine Special Area of Conservation in South Wales, was historically the location of one of the principal Native Oyster (*Ostrea edulis*) beds in Wales. Overfishing in the 1800s near universally drove the Native Oyster to commercial and functional extinction throughout its European range. A host of other threats including sedimentation, poor water quality, trawling and disease have contributed to its continued status as a threatened species. The European Native Oyster is currently listed by OSPAR as a threatened and/or declining species and habitat and as well as a Biodiversity Action Plan Species in the UK. It is also listed in Section 7 of the Environment (Wales) Act 2016. It is considered to be a component of the Estuaries, Large shallow inlets and bays, and Reef features of the Pembrokeshire Marine Special Area of Conservation. Today, Native Oysters are known to be scattered throughout the Milford Haven Waterway, albeit at very low densities.

An extensive survey of the historical oyster areas of the Milford Haven Waterway was undertaken in late 2016/early 2017 by box grab, intertidal transect and Seasearch diver transects and quadrats. The surveys found the Native Oyster population within the Milford Haven Waterway to be widely distributed at low densities (mean 0.05-0.17 m⁻²). There are, however, some localized areas where oysters were found at substantially higher densities. The mean oyster size did not differ significantly from earlier surveys, which implies that some limited recruitment has taken place. The surveys undertaken in Milford Haven have, however, consistently found there to be a low abundance of spat (newly settled oysters), which suggests that this recruitment is extremely limited. As in other parts of its range, active restoration is highly likely to be necessary to allow the existing population of Native Oysters to recover.

It can be concluded from the surveys undertaken and outlined in this report that the current most likely contributors to the low oyster densities and recruitment in Milford Haven are: lack of broodstock, *Bonamia* and low quality cultch. It is recommended that phase 2 of the Milford Haven Native Oyster regeneration project focus on mitigating the threat posed by the lack of broodstock and the impact of *Bonamia*. Improving cultch is also likely to be beneficial to the population, however, it is critical at this stage to first address the lack of larvae. Consideration of cultch quality should be undertaken alongside efforts to increase recruitment, to ensure that the additional larvae generated through restoration have the best chance of survival and growth.

Suggested next steps to be taken to restore or recover the Native Oyster in the Milford Haven Waterway include:

1. Relaying of existing oysters into brood stock areas to increase the probability of successful fertilization and therefore enhance recruitment.
2. Addition of hatchery reared stock, or stock purchased from another fishery to increase the density of oysters within the Milford Haven Waterway and therefore to enhance recruitment.
3. Mapping/monitoring the current prevalence of *Bonamia* within the Milford Haven Waterway such that it can be accounted for in restoration design and adaptive management. Projects should aim to support the development of *Bonamia* resistant genotypes within the Native Oyster population.
4. Monitoring of oyster larvae and spat settlement to ensure that best practice is achieved.

Full report available under license from Natural Resources Wales (please enquire via Sue Burton - sue@pembrokeshiremarinesac.org.uk, Tel: 01646 696108).

4. Future work programme

The upcoming year of 2018 marks the 25th anniversary of the Milford Haven Environmental Surveillance Group. The Group is planning to use the occasion to take stock of what it has achieved so far through collaborative working. It will also be an opportunity to remind members and parent organisations of the circumstances surrounding the Group's origins and the continued need for high quality data for the waterway.

Sediment contaminants in the waterway have been the subject of comprehensive reviews of sediment transport, forensic analysis of hydrocarbon contamination, data inconsistencies arising from evolving laboratory methods over 40 years, culminating with the establishment of a past timeline of sediment contamination in the waterway. A consistent recommendation from this research over the years is the need to establish routine surveillance of sediment contamination in the Milford Haven Waterway as a core component of the Group's environmental quality surveillance. It is anticipated that this routine surveillance of sediment contaminants will be developed and implemented in 2018.

The well-established annual wetland bird surveillance projects (wildfowl and wader counts and the annual survey of summer shelduck population) are scheduled to continue into 2018.

Throughout its existence, the Group has periodically paused to review existing data, to identify gaps and agree priorities before embarking on a renewed work programme. The 25th year of the Group in 2018 will be timely to once again undertake an objective review of existing and potentially new research priorities.

Appendices

Appendix 1: Purpose and terms of reference

Preamble

The Milford Haven Waterway¹ 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.
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.

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.

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 / MHWESG² 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*. 7pp + 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*. 7pp + 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

Mieszowska, 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

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Average size of shelduck broods recorded 1991 - 2017

