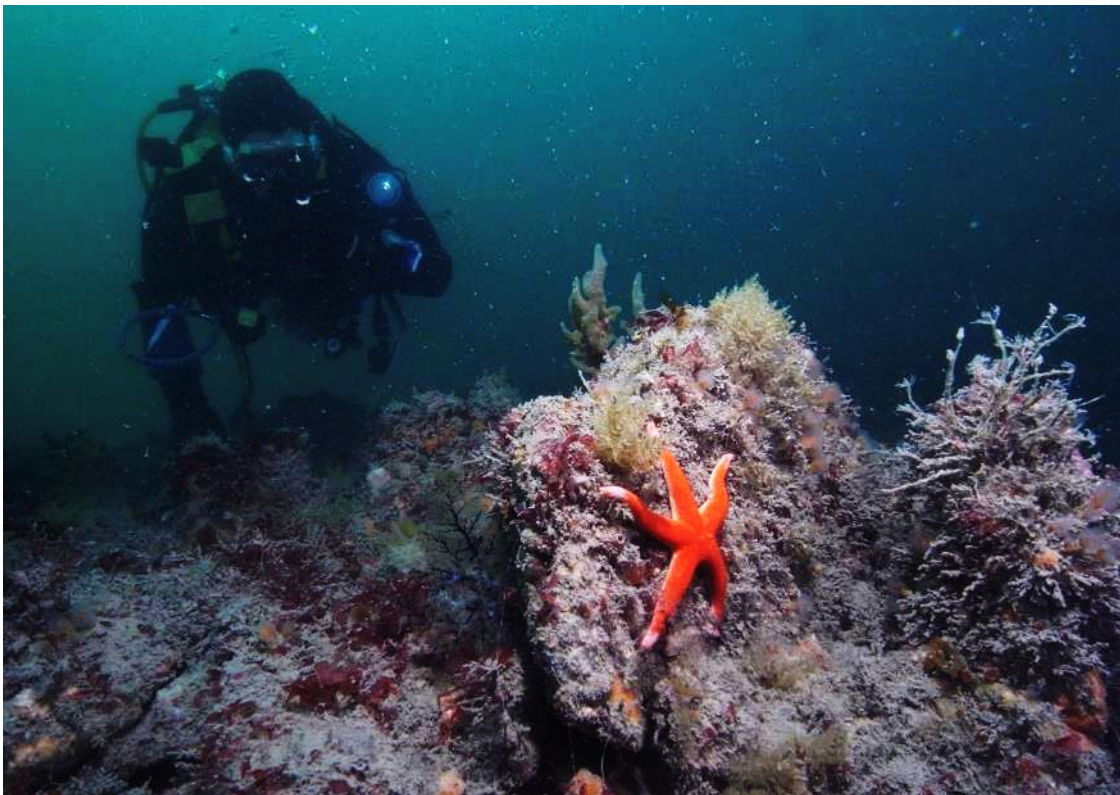




SEASEARCH SURVEYS IN MILFORD HAVEN A TWELVE YEAR SUMMARY 2004 – 2015



Report prepared by Kate Lock and Blaise Bullimore

Seasearch South and West Wales

March 2018

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Natural Resources Wales.**



Cover image: Blaise Bullimore

Arolygiadau seasearch yn Milford Haven: crynodeb dros y flwyddyn 2004 – 2015

CRYNODEB

Prosiect 'gwyddoniaeth y dinesydd' ar gyfer arolygu'r môr trwy ddeifio yw Seasearch, ar gyfer deifars hamdden a deifars proffesiynol fel ei gilydd. Mae deifars Seasearch yn cwblhau arolygon cost-effeithiol, gan gofnodi a thynnu lluniau rhywogaethau a chynefinoedd, a llenwi ffurflenni arolygu manwl y sicrhawyd eu hansawdd, sy'n cyfrannu at gasgliadau data Seasearch a chronfa ddata arolygon môr y DU, sef Marine Recorder.

Cwblhawyd tri deg o ddiwrnodau arolygon deifio Seasearch yn Nyfrffordd Aberdaugleddau rhwng 2004 a 2015. Llwyddodd 104 o ddeifars gwirfoddol unigol i gwblhau 287 o ffurflenni arolygu ar gyfer 43 o safleoedd. Roedd y safleoedd a arolygwyd yn ymestyn o Langwm Ferry yn rhannau uchaf Daugleddau, ar hyd Aberdaugleddau at Benrhyn Santes Ann ar yr ochr orllewinol ac Ynys y Defaid ar ochr ddwyreiniol mynedfa'r Ddyfrffordd.

Yn ychwanegol at gynyddu'n fawr yr wybodaeth sylfaenol am ddsbarthiad cynefinoedd a rhywogaethau gwely'r môr yn y Ddyfrffordd, mae'r arolygon wedi cofnodi 7 o rywogaethau a chynefinoedd â blaenoriaeth Adran 7 Deddf yr Amgylchedd (Cymru) 2016, rhywogaethau estron a goresgynnol a rhywogaethau prin ac anfynych nodedig. Mae gwybodaeth am bresenoldeb y rhywogaethau hyn a'u lleoliad yn arbennig o ddefnyddiol.

Gweithiodd deifars Seasearch, staff morol Cyfoeth Naturiol Cymru, Swyddog ACA Sir Benfro Forol a rheolwr prosiect Grŵp Gwyliadwriaeth Amgylcheddol Dyfrffordd Aberdaugleddau yn agos, ac mae'r cydweithio hwn wedi ei gwneud yn bosibl i'r arolygon dargedu ardaloedd yn effeithiol. Gellir defnyddio'r data am rywogaethau a chynefinoedd a'r casgliad sylweddol o ddelweddau digidol i gynorthwyo gyda'r gwaith cynllunio rheoli a'r gwaith o asesu datblygiadau arfaethedig ar gyfer yr ardal.

Mae'r amodau deifio yn aberoedd Cleddau ac yn Nyfrffordd Aberdaugleddau yn anodd a rhaid cynllunio'n ofalus. Yn aml, nid yw'n hawdd gweld dan y dŵr, ond mae cyfoeth bywyd gwyllt morol y ddyfrffordd a'r cofnodion, y ffotograffau a'r profiad a gafwyd gan ddeifars Seasearch yn yr ardal, yn werthfawr ac yn gwneud yr ymdrech yn werth chweil.

Seasearch surveys In Milford Haven: a twelve year summary 2004 – 2015

SUMMARY

Seasearch is a UK 'citizen science' diving marine survey project for both recreational and professional divers. Seasearch divers carry out cost-effective surveys, recording and photographing species and habitats, and completing detailed, quality assured, survey forms which contribute to the Seasearch data holdings and the UK's marine survey database, Marine Recorder.

Thirty Seasearch diving survey days were completed in the Milford Haven Waterway between 2004 and 2015. In total, 104 individual volunteer divers completed 287 survey forms for 43 site areas. Sites surveyed extend from Llangwm Ferry in the upper reaches of the Daugleddau through the length of Milford Haven to St Ann's Head on the western side and Sheep Island on the east side of the entrance of the Waterway.

In addition to substantially increasing baseline knowledge of seabed habitats and species distributions in the Waterway, the surveys have recorded Environment Act (2016) Wales Section 7 priority species and habitats, non-native and invasive species and notable rare and scarce species. The knowledge of the presence of these species and their locations are particularly useful.

Seasearch divers, Natural Resources Wales marine staff, the Pembrokeshire Marine SAC Officer and the Milford Haven Waterway Environmental Surveillance Group (MHWESG) project manager worked closely together and this partnership working has allowed the surveys to target areas effectively. The species and habitat data and the considerable collection of digital images stored can be used to support management planning and assessment of proposed developments for the area.

Diving conditions in the Cleddau estuaries and Milford Haven Waterway are challenging and careful dive planning is needed. Poor underwater visibility is common but the richness of the waterway's marine wildlife and the records, photographs and experience acquired by Seasearch divers in the Haven are rewarding and make the effort worthwhile.

SEASEARCH SURVEYS IN MILFORD HAVEN
A TWELVE YEAR SUMMARY 2004 – 2015

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1. INTRODUCTION

1.1 THE MILFORD HAVEN WATERWAY

The Milford Haven waterway is a ria-estuary, an uncommon estuary type restricted in the UK to southwest England and Wales. It is the only ria in Wales and the largest ria-estuary complex in the UK. It is of considerable marine ecological significance, one of the most biologically diverse and important marine inlets in the UK, where marine wildlife penetrates deep inland in almost fully saline conditions but nearly completely sheltered from wave action. It is one of the best examples of a ria system in Britain (Hiscock, 1998).

The ria was formed about 80,000 years ago as the sea rose and flooded deep channels created by glacial erosion during the last ice age maximum. The underlying geology – the diversity of rock type, and the distribution of rock folding, faulting and fracturing - is responsible for the overall complex shape of the waterway, the diversity of habitats, and the complex structure which strongly influences hydrographic processes which, in turn, generate a wide range of environmental conditions, seabed substrates, tidal streams and salinity gradients,

Milford Haven waterway includes habitats that range from subtidal and foreshore rock through mixed sediments of every kind, to soft muds in embayments and tributary estuaries. High-salinity water and rocky substrates penetrate far upstream supporting communities characteristic of fully saline conditions in sheltered waters. A wide range of subtidal and intertidal rocky habitats are present, from rocky reefs and boulders to biologically rich under-boulders, crevices, overhangs and pools. A major factor in the nature conservation importance of Milford Haven is the continuum of ecological variation within the system.

A wide diversity of communities and species is associated with the wide range of environmental conditions. The species-richness of sediment communities throughout Milford Haven and the Daugleddau is high and wide intertidal mudflats support abundant and productive invertebrate communities. Tide-swept sponge communities on shell/cobble substrates and bedrock in the upper reaches of the Daugleddau are exceptionally diverse.

The waterway is wholly encompassed within the Pembrokeshire Marine Special Area of Conservation (SAC), a European Union designation that recognises its unique and diverse marine species and habitats as being of European importance (JNCC, undated; Burton, 2008).

The deep-water channel of the lower Haven provides a natural harbour with a long and distinguished history. Iron Age promontory forts are scattered on headlands at the entrance and along the course of the Haven and the Daugleddau. Settlements bear names derived from Viking visitors. In his play *Cymbeline*, Shakespeare asks “how far it is to this same blessed Milford: and by the way tell me how Wales was made so happy as to inherit such a haven”. Henry Tudor landed at Dale in 1485 before marching to defeat Richard III at the Battle of Bosworth. In *The Description of Pembrokeshire*, published in 1603, George Owen claimed that Milford Haven was the most famous port of Christendom. Two centuries later, Nelson described it as the next best natural harbour to Trincomalee in Sri Lanka and “the finest port in Christendom” (McKay 1989).

Human pressures in the Haven began long before Milford Haven’s oil port era began in 1960, by which time the waterway had already acquired a legacy of human impacts. The waterway was a hive of industry from the medieval period, with saw-mills, paper mills, tanneries and limestone burning on shores, coal exporting from the 13th century and

herring from the 14th (Little, 2009). The waterway supported a major naval dockyard during the 19th century and was an important naval base in both World Wars. The Luftwaffe's bombing of the Royal Navy's fuel oil storage depot at Pembroke Dock in August 1940 started the largest 'single-seat' fire in the UK's history (Scott, 1980) and released an unquantified volume of fuel oil into the waterway and the underlying ground, traces of which are still emerging in groundwater (Galperin & Little, 2014).

Whilst local habitat loss possibly began with the construction of medieval quays, jetties and landing places, substantial losses began with the claiming of mudflats to build the naval dockyard in the 1820s. A study of coastal change since the 1940s estimated a further 60ha were lost in the 50 years to 2000 (Howell, 2002).

Although the significance of Milford Haven as an oil port has declined since peak imports during the 1970s, it remains the largest port in Wales and the third largest in the UK, handling about 29% of Britain's seaborne trade in oil and gas. It is also home to a twice-daily ferry service to Ireland and Pembroke Port accommodates a variety of general cargo and heavy lift vessels (PoMH, 2016).

The industries and their associated supporting maritime businesses surrounding the Haven constantly change; three refineries have closed since 1980 and two Liquid Natural Gas terminals opened in the 2000s, whilst a decommissioned oil fired power station was replaced by a gas fired station. The waterway was an important fisheries centre in the early-mid 20th century, but Milford Haven Docks are now dominated by leisure boating facilities as the Haven has become an increasingly important recreational resource supporting substantial marinas.

The legacy of centuries of commercial shipping and industrial activities is a range of both long and short-term environmental impacts that includes lost habitats, contaminated sediments and biota, and introduced non-native species (eg. Little, 2009; Langston *et al*, 2012; Jones & Jones 2015).

Although the waterway has been well studied compared with most other UK marine and estuarine areas, the co-existence of its extremely varied habitats and species with the diversity and intensity of human activity results in an ongoing need for long term monitoring of potential human impacts and environmental change (Bullimore, 2013).

1.2 MARINE BIOLOGICAL SURVEY IN MILFORD HAVEN

Milford Haven is one of the most well studied marine areas in the UK. The waterway has attracted naturalists for many decades and aspects of its marine biology have been thoroughly and repeatedly described. The breadth of studies up to the late 1980s, and the environmental conditions at the time were reviewed by Little & Hiscock (1987) and Hobbs & Morgan (1992).

Research and surveys were carried out by Swansea University from the 1950s and later by the Field Studies Council's (FSC) Dale Fort Field Centre, which published the *Dale Fort Marine Fauna* in 1966 (Crothers, 1966) and, from 1967, by the FSC's Oil Pollution Research Centre (Baker, 1987; Dicks, 1987).

The majority of biological survey effort was focused on ornithology, rocky shores intertidally, and sediment macrobenthos subtidally. However, subtidal areas only accessible by diving have been surveyed since the 1960s when one of the earliest documented systematic SCUBA surveys was carried out in the Daugleddau (Bailey *et al* 1967).

Until recent years, much of the diving survey effort has been focused in the upper Haven (eg. Case, 1981; Moore, 2004) or at a small suite of locations (Bunker & Rostron, 1998; Munro, 1999) and the only Haven-wide diving survey is thirty years old (Little & Hiscock (1987).

1.3 SEASEARCH

Seasearch is a UK volunteer project for both recreational and professional divers. The divers are trained in species and habitat recording and help survey the seabed around the British and Irish coasts. Completed survey forms¹ are quality checked by experienced marine biologists who enter all data into the UK national database Marine Recorder, managed by Joint Nature Conservation Committee (JNCC), which contributes to the National Biodiversity Network.

The main aim is to provide quality assured Seasearch data to partner organisations and the public. However, the project also aims to raise public awareness of the diversity of marine life and habitats in Britain and Ireland through the dissemination of information gathered and the identification of issues arising from it.

Seasearch surveys record the various types of seabed found in the near-shore zone around the whole of the UK and, as comprehensively as possible, the identity and frequency of the dominant animals and plants living at each survey site. Species frequencies are recorded using established semi-quantitative abundance scales (Hiscock, 1996²). Habitats described on the survey form are assigned a biotope code by an experienced post survey analyst, using the JNCC Marine Nature Conservation Review (MNCR) set of biotopes (JNCC, 2015). Sublittoral biotopes are split into infralittoral and circalittoral; infralittoral referring to shallow, seaweed dominated, habitats below extreme low water and circalittoral referring to animal dominated habitats, usually below about 15m depth.

The surveys contribute to establishing the location of the richest sites for marine life, sites where there are environmental pressures and sites which are in need of protection.

Surveys target important habitats and species that have been identified by governments to need priority conservation action. In Wales these are detailed in Section 7 of the Environment (Wales) Act 2016, which identifies duties to maintain biodiversity lists and to take steps to maintain and enhance biodiversity. Other important species recorded include invasive and non-native species (INNS) and notable species which have limited distribution ranges in the UK or are nationally rare or scarce.

Underwater photography has become an invaluable Seasearch tool throughout the period covered by this report. The increasing accessibility to and relative affordability of compact digital cameras and dedicated underwater housings has not only enabled Seasearch divers to improve their recording and identification skills, but has also generated a huge

¹ <http://www.seasearch.org.uk/recording.html>;
<http://www.seasearch.org.uk/downloads/survform01-14web.pdf>

² S = Super-abundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare and NS = Not Seen. Actual numerical frequencies vary with taxonomic group and species. Abundance scores in the text are capitalised to distinguish them from standard grammatical usage, eg Common versus common.

resource of species and habitat images. Most Seasearchers are set up for macro (close-up) photography because of frequent low visibility in many UK waters, its relatively technical ease and minimal equipment requirements. Whilst the focus on macro has yielded very many extremely useful photographs, it has unfortunately resulted in a relative sparseness of good representative habitat images.

2. SEASEARCH IN MILFORD HAVEN WATERWAY 2004 TO 2015

2.1 SURVEY SUMMARY

Seasearch efforts in the Milford Haven waterway began in 2004. The aims have evolved over the years but primarily include:

- filling gaps in survey coverage;
- revisiting locations that have not been recorded for many years, several decades in some instances;
- surveying rocky seabeds, with emphasis on previously unknown areas of reef revealed by a comprehensive multibeam acoustic survey carried out by Countryside Council for Wales (CCW; now Natural Resources Wales (NRW)) in 2000;
- targeting selected species in support of Section 7 priority species and habitats, local Biodiversity Action Plan (BAP) and Pembrokeshire Marine SAC data needs, eg native oyster and crawfish surveys; non-native species assessments; photographing and collecting specimens to contribute to development of the Seasearch ascidian identification guide.

In addition to contributing to the Seasearch data holdings and the UK's marine survey database Marine Recorder, information has been shared directly with CCW / NRW, Pembrokeshire Marine SAC, Pembrokeshire Nature Partnership (local Biodiversity Action Plan partnership), the authors of the Seasearch ascidian identification guide and Milford Haven Waterway Environmental Surveillance Group (MHWESG).



Divers taking a break between dives on board the Cleddau King

Undoubtedly, because of pressures, changing activities, climate change and the arrival of non-native species there will be ongoing needs for high quality diving observations and records to supplement formal monitoring and surveillance programmes, in particular those carried out by NRW and industry which are focused on statutory monitoring obligations and permit compliance monitoring rather than the opportunistic, reactive or special interest survey and surveillance Seasearch is able to conduct.

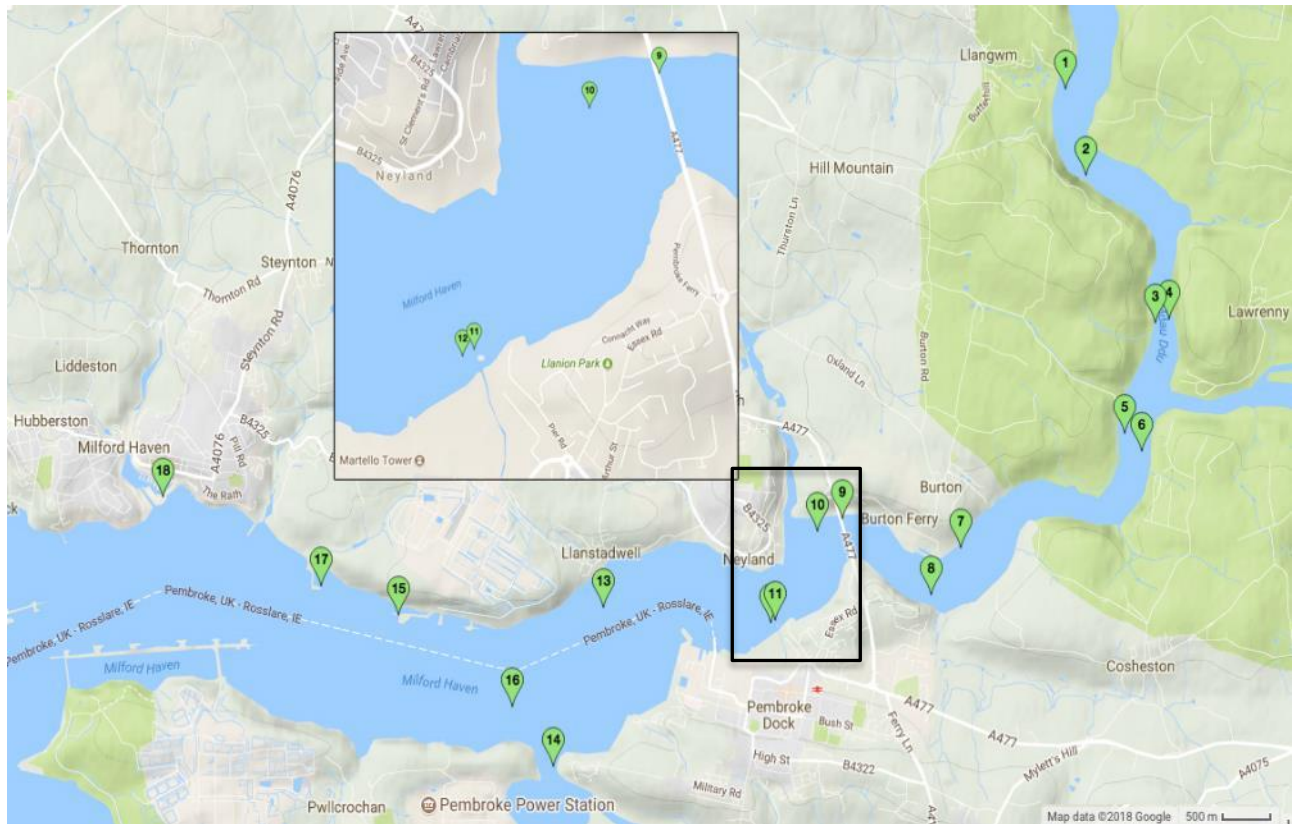
One weekend of Seasearch surveys in Milford Haven was completed in 1999, but specific efforts to survey sites in the waterway did not begin until 2004. Site selection and surveys were carried out in liaison with CCW, later NRW, marine staff, the Pembrokeshire Marine SAC Officer and the MHWESG in order to ensure that data collected would be useful to management needs of the area.

Thirty survey days have been completed with 104 individual volunteer divers involved. In total, 287 survey forms have been completed for the 43 sites as shown Maps 1 and 2, with 29 MNCR biotopes identified (see Appendix 1) and over 350 species recorded.

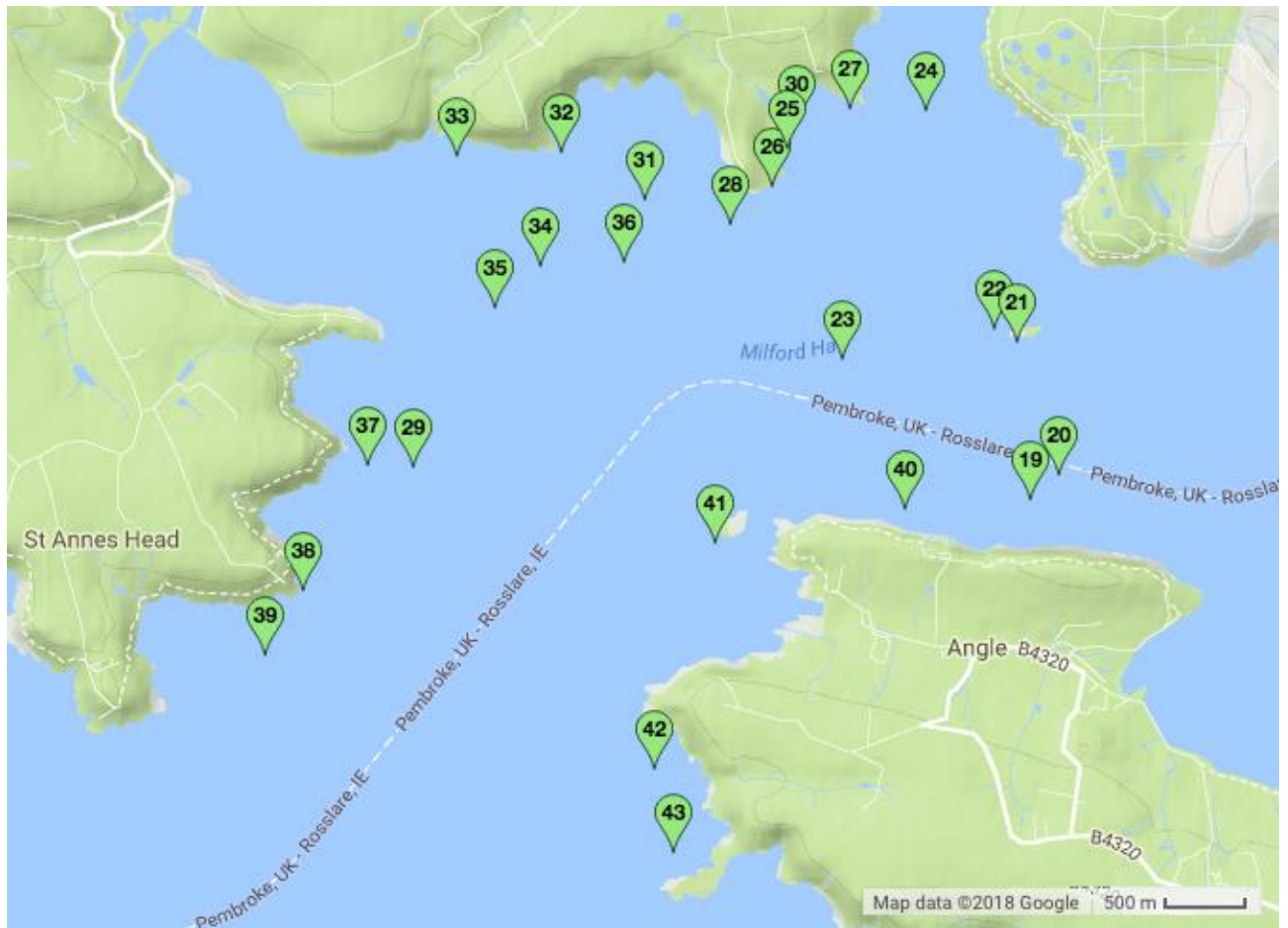
Sites surveyed extend from Llangwm Ferry in the upper reaches of the Daugleddau through the length of Milford Haven to St Ann's Head on the western side and Sheep Island on the east side of the entrance of the waterway. Survey effort is reasonably evenly distributed with 130 forms from 18 sites covering the mid to upper waterway upstream of Stack Rock (Map 1) and 158 forms from 25 sites from the lower waterway and entrances (Map 2). Summary site descriptions are detailed in Section 3. Depths are reported are below chart datum.

A considerable library of underwater digital images has been built up during the period of Seasearch surveys in Milford Haven. Although the typical diving conditions of relatively poor underwater visibility within the Haven, particularly upstream of Pembroke Dock / Neyland, has resulted in the overwhelming majority of images being close-up (macro) photographs of individual species and species assemblages, the determined efforts of some Seasearch photographers have generated a useful range of representative, if not necessarily high quality, habitat images.

Seasearch surveys in Milford Haven A twelve year summary 2004 - 2015



Map 1. Survey sites 1 to 18 in the mid to upper Milford Haven waterway



Map 2. Survey sites 19 to 43 in lower waterway and entrances of Milford Haven.

2.2 IMPORTANT SPECIES RECORDING

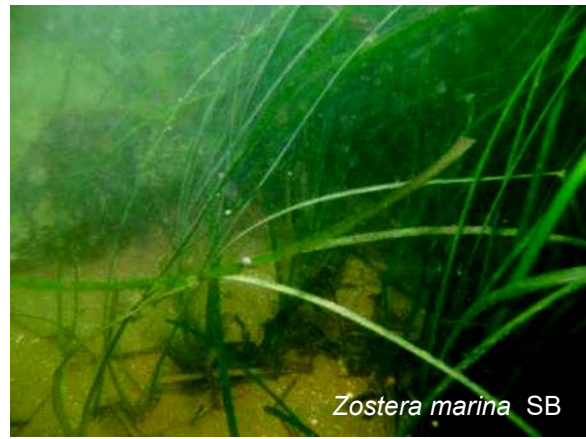
2.2.1 Priority species and habitats

The Wales “section 7 list” is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty “to have regard” to the conservation of biodiversity in all their activities.

Within Milford Haven waterway, Seasearch has recorded and surveyed 6 priority habitats and species: eelgrass beds (*Zostera marina*), tidal rapid reefs, native oysters (*Ostrea edulis*), fan shell (*Atrina fragilis*), crawfish (*Palinurus elephas*) and stalked jelly fish (*Lucernariopsis campanulata*).

Eelgrass (*Zostera marina*) beds

Zostera marina is the only flowering plant within the British Isles that grows and produces seed entirely submerged by seawater. Eelgrass (or seagrass) beds are highly productive habitats and provide an important stabilising function for mobile marine sediments. The maintenance of eelgrass beds directly influences the associated algal and invertebrate communities that are supported by them. These communities are important sources of food for other marine animals and birds. The optimal growth conditions are in relatively shallow, sheltered and stable environments (Unsworth, 2017).

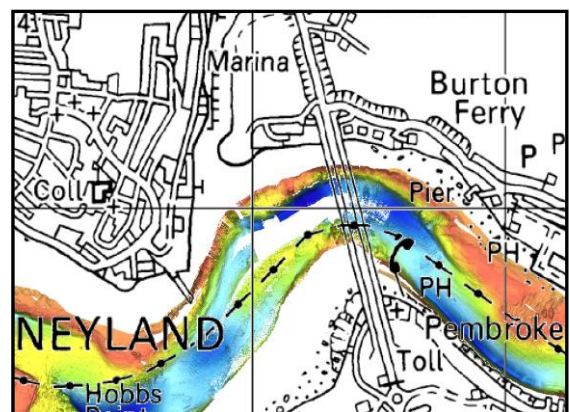


A CCW volunteer diving survey was organised by Marine Ecological Solutions Ltd in 2010 to survey the status of a small eelgrass bed in Longoar Bay, located at the entrance of Sandy Haven, (Goudge & Morris, 2010). In addition to producing a baseline map of the bed, Seasearch forms were completed to record details of the habitat and other species found.

Tidal rapid reefs

The term ‘tidal rapids’ is used to cover a broad range of high-energy environments. Rocky reefs subject to strong tidal streams support marine communities with rich species diversity, nourished by a constantly renewed food source brought with each tide.

The rocky, tide-swept habitats in Milford Haven and the Daugleddau estuary are one of the key features of the reefs present in the Pembrokeshire Marine SAC and are considered of both national and European importance.



High resolution multi-beam bathymetric surveys of Milford Haven conducted in 2000 revealed possible rocky features that had not been previously known. Potential reef features were identified from the multi-beam survey outputs by Mike Camplin (CCW / NRW Specialist Monitoring Team Leader) and survey positions were provided to

Seasearch to investigate.

Surveys in the upper waterway were targeted at Llandstadwell, Barnlake and the Cleddau Bridge and vertical walls were located at all three. Two sites in Castle Reach were also targeted. Each site was rich in marine life with thick coverings of sponges, hydroids and ascidians plus a diverse range of associated nudibranch sea slugs. In the lower waterway, surveys were carried out on rock pinnacles revealed by the multibeam work in Sandy Haven Bay and tide-swept rocky reefs in Lindsay Bay.

Native oyster *Ostrea edulis*

Historically, Milford Haven supported a thriving oyster fishery, but overexploitation led to population collapses. Although oyster numbers are low, the waterway is the only currently known location for live oysters in Pembrokeshire.

Emu Ltd carried out a survey for CCW in 2002 to assess the distribution and abundance of the native oyster in Milford Haven. In 2007, Seasearch repeated the survey at two of the sites, completing transect counts and recording current condition. A further six sites were surveyed 2010 and 2011. Low numbers of native oysters were found at each site but the sediment substrate was dominated by the non-native invasive slipper limpet, *Crepidula fornicata*, which at some sites was recorded as Superabundant. The oyster density data collected during these surveys and abundance data recorded on Seasearch dives has been entered into the Marine Recorder database but not included in this report because of data sensitivity.



Fan shell *Atrina fragilis*

The fan shell is a large, nationally scarce, bivalve mollusc. Current records of the fan shell show that it is now only found at sites in Scotland and two sites on the south coast of England: Plymouth Sound and Salcombe Bay. However, there are historical records from Wales of fan shells in Carmarthen Bay and near Stack Rock in Milford Haven.

The then Seasearch National Coordinator, Chris Wood, organised and led a survey targeting these Welsh sites in 2003. Although suitable sediment habitats were found at all sites no living specimens were recorded. The only record of the species was of a single shell found amongst shell debris close to Stack Rock, Milford Haven (Wood, 2003).

Further surveys dives were targeted around Stack Rock and areas east of the Dakotian wreck in 2007. No fan shells were found despite suitable habitat being present at both sites.

Crawfish *Palinurus elephas*

Crawfish are an important scavenger on rocky reefs and are a key component of the reef feature of the Pembrokeshire Marine SAC. Populations have been in decline since the 1960s because of fishing effort by both potting and collection by scuba divers (Hunter *et al*, 1990), with stocks in the mid 2000s being described as 'residual' (ICES 2006).

Numbers of crawfish are currently very low in the UK but they are still seen, in small numbers, around Wales at sites off the Pembrokeshire coast and the Llyn Peninsula. An assessment of sightings based on historical diver records in Wales was compiled in 2010 (Lock, 2010). Despite being identified as a species of conservation concern it is still commercially sought and some commercial netting is still pursued around the Pembrokeshire coast.



Palinurus elephas KL

Crawfish have been only recorded by Seasearch in Milford Haven at two sites in the waterway entrance.

Stalked jelly fish *Lucernariopsis campanulata*

Stalked jellyfish are an unusual member of the Cnidaria (jellyfish, corals and anemones) as they do not have two phases in their lifecycle (attached and free-drifting) but remain attached to seaweed or seagrass all their lives.



Lucernariopsis campanulata SB

Although this species of stalked jellyfish is widespread around the British Isles it is rarely recorded due to its small size as it is very camouflaged when on seaweed. It was found in 2010 attached to eelgrass, *Zostera marina*, in Longoar Bay.

2.2.2 Non-native and invasive species

Marine non-native species (NNS) are an increasing concern globally, particularly those that have serious impacts on native species, health or economy, described as invasive non-native species (INNS). The UK Marine Pathways project was established in 2013 to protect marine biodiversity in the UK and Ireland from pressure from INNS by managing key pathways by which marine INNS are introduced and spread. An important element of the project was the development of recording and monitoring protocols for marine NNS.

Milford Haven is a known marine NNS 'hotspot' and surveyors are routinely reminded to maintain a watchful eye for non-natives. Many NNS are difficult to identify or are easily overlooked so photography has proved a particularly useful tool in recording NNS during surveys. In 2014, Dragon LNG funded a boat charter for Seasearch to specifically record NNS on their jetty piles (Bullimore, 2014).

Seasearch surveys have recorded the following six non-native species in Milford Haven:

Compass sea squirt *Asterocarpa humilis*

Site: Dragon LNG jetty



Orange tipped sea squirt *Corella eumyota*

Site: Dragon LNG jetty



Leathery sea squirt *Styela clava*

Sites: Castle Rocks, Dragon LNG, Stack Rock, Landing Craft



Japanese wire weed *Sargassum muticum* Site: Longoar Bay

Slipper limpet *Crepidula fornicata*

Sites: Llangwm ferry, Beggars Reach, Castle Rocks, Rhooseferry moorings, Jenkins Point, Rudders moorings, Warrior, North Cleddau bridge, Pennar gut, Dragon LNG, Pwllcrochen flats. Newton Noyes jetty.



Crepidula fornicata DK

Orange sheath tunicate, *Botrylloides violaceus*

Site: Landing craft



Botrylloides violaceus DK

2.2.3 Other notable species records.

These species are notable for their rarity or scarcity in the UK or Wales, including some close to the edge of their distribution range, or being unrecorded previously in the UK or possibly new to science, such as some ascidian (sea squirt) species which seem to be locally common in Pembrokeshire.

- *Didemnum pseudofulgens* sea squirt recorded at Rat Island reef, first record for Milford Haven and Wales, second record in the UK.



Didemnum pseudofulgens BB

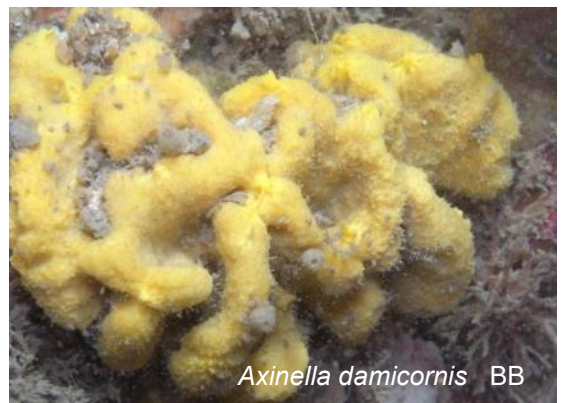
- Un-named sea squirts: 'Strawberry', 'Honeycomb' and 'Caramel two spot' *Aplidium* species at Rat Island reef, Linsday Bay and Watwick reef. Little is known about them and they have not yet been scientifically named.



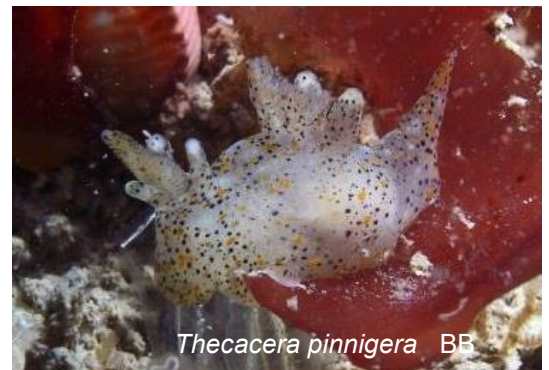
- Scarlet and gold cup coral *Balanophyllia regia* at Great Castle Head, first record for the entrance of Milford Haven. It is a scarce UK species, typically found in surge gullies, with the northernmost UK record in North Pembrokeshire.



- Nationally scarce sponges: mashed potato sponge, *Thyrosia gurnei*; yellow staghorn sponge, *Axinella dissimilis*; brain sponge, *Axinella damicornis* and the prawn-cracker sponge, *Axinella infundibuliformis* at several sites in the entrance of Milford Haven.



- Nationally scarce nudibranch species: *Palio nothus*, *Thecacera pennigera* and *Trapania pallida*.



3. SITE SUMMARIES

SITE 1: LLANGWM FERRY

The site was a flat estuary bed of muddy shell gravel covered in an abundance of slipper limpets, *Crepidula fornicata*, and Occasional blue mussels, *Mytilus edulis*. Small ridges of shells and a scattering of pebbles and small boulders provided a substrate for the sponges mermaids glove, *Haliclona oculata*, breadcrumb sponges *Halichondria panacea* and *H. bowerbanki* and spiky lace sponge, *Leucosolenia complicata*. Groups of horseman anemone, *Urticina eques*, and dahlia anemone, *Urticina felina*, were found along with numerous gobies and shore crabs, *Carcinus maenas*.



Urticina eques DK

SITE 2: BEGGARS REACH

The main area of the estuary bed was a pebble plain with occasional boulders. A Superabundance of the slipper limpet, *Crepidula fornicata*, was found forming a dense bed over the substrate. Small boulders provided the only attachment points for sponges, including *Suberites ficus*, and bryozoan, *Bugula plumosa*. Amongst the slipper limpet bed there were Occasional horseman anemone, *Urticina eques*, and dahlia anemone, *Urticina felina*.



Bugula plumosa on pebbles and boulders BB



Sketch: Richard West

SITE 3: CASTLE ROCKS WEST SHORE

A rugged rocky reef extended to 13m depth with steep faces up to 3m height. The rocks were smothered in Superabundant breadcrumb sponge, *Halichondria panicea* and mermaid's glove, *Haliclona oculata* along with an abundance of the oaten pipe hydroid, *Tubularia indivisa*, and the finger bryozoan, *Alcyonidium diaphanum*. Occasional yellow seasquirt, *Ciona intestinalis*, and the leathery sea squirt, *Styela clava* were also recorded.



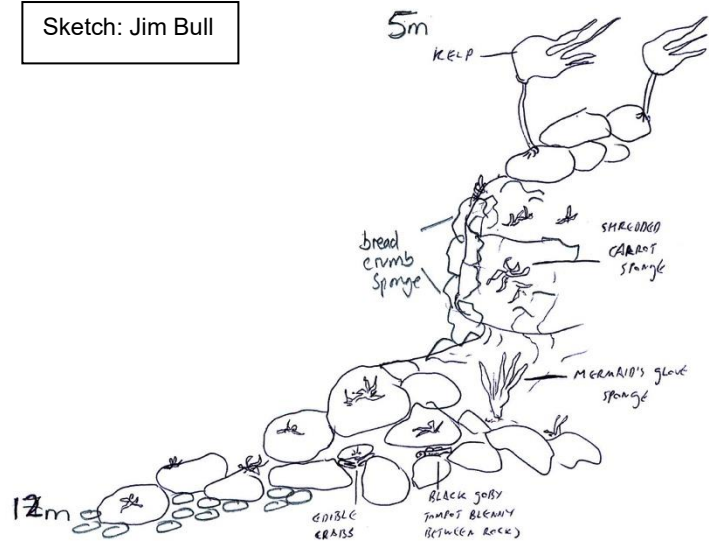
Haliclona oculata and *Halichondria panicea* FB

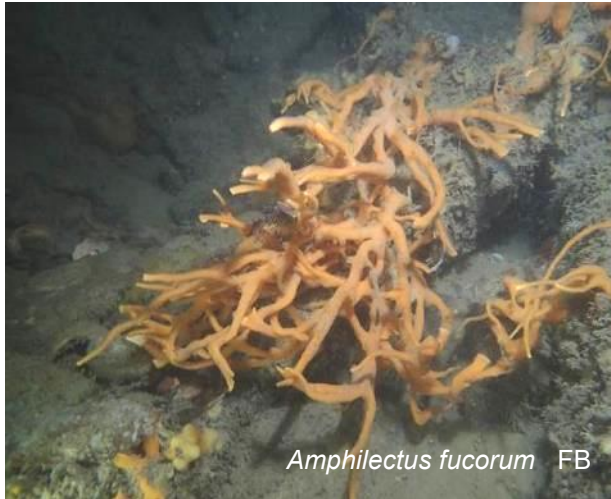
Above and below the steep rock wall were cobble and pebble areas thickly carpeted in slipper limpets, *Crepidula fornicata*. Dense coverings of hydroids, including *Obelia* species, and anemones *Diadumene cincta* were found on the shells together with horseman anemone, *Urticina eques* and dahlia anemone, *Urticina felina*, the elegant anemone, *Sagartia elegans*, and *Sagartia troglodytes*.

SITE 4: CASTLE ROCKS EAST SHORE

A sloping reef extended to 17m depth. In the shallows a kelp park of *Laminaria hyperborea*, heavily overgrown with kelp fir, *Obelia geniculata*, extended to 5m depth, below which was a steep slope of mixed substrates comprising bedrock and varying sizes of boulders, cobbles and pebbles. Sponge species dominated rocky surfaces deeper than the kelp, in particular the breadcrumb, *Halichondria panicea*, and shredded carrot sponge, *Amphilectus fucorum*. Also Common was the current-loving oaten pipe hydroid, *Tubularia indivisa*. Several fish species were found amongst the pebbles and in crevices, in particular rock goby, *Gobius paganellus*, and black goby, *Gobius niger*.

Sketch: Jim Bull





Amphilectus fucorum FB



Tubularia indivisa DK

SITE 5: RHOOSFERRY MOORINGS

A steep slope characterised by rock rubble encrusted in sponge, *Halichondria bowerbankii*, led down to a generally level, mixed substrate seabed with large scoured boulders near the moorings. The mixed seabed was highly mobile with white striped anemones, *Actinotheroe sphyrodeta*, being one of the few sessile animals recorded. Patches of slipper limpets, *Crepidula fornicata*, were present with occasional shredded carrot sponge, *Amphilectus fucorum*, and sea orange, *Suberites ficus*, attached to them. Moorings made from concrete blocks and tyres were encrusted in finger bryozoan, *Alcyonidium diaphanum*, and sponge sea squirt, *Diplosoma spongiforme*. Mooring ropes were heavily encrusted with helter-skelter hydroid, *Hydrallmania falcata*, along with occasional oaten pipe hydroids, *Tubularia indivisa*.



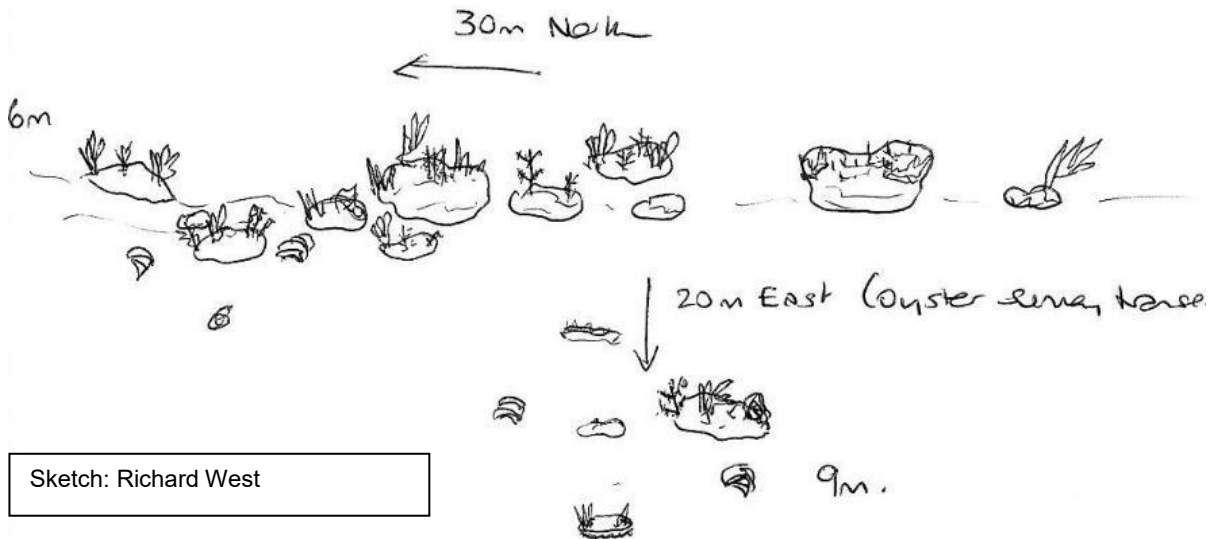
Actinotheroe sphyrodeta and
Crepidula fornicata DK



Amphilectus fucorum, *Suberites ficus* and
Crepidula fornicata DK

SITE 6: JENKINS POINT

Small boulders smothered in sponges and hydroids typified the area. The finger bryozoan, *Alcyonidium diaphanum*, was Frequent, often with the white hedgehog sea slug, *Acanthodoris pilosa*, feeding on it, and aggregations of large sea lemons, *Doris pseudoargus*, with egg masses. Anemones included the horseman anemone, *Urticina eques*, daisy anemone, *Cereus pedunculatus*, and the elegant anemone, *Sagartia elegans*. The common hermit crab *Pagurus bernhardus*, shore crab, *Carcinus maenas*, and the sand mason worm, *Lanice conchilega*, were recorded as Frequent. Only three species of fish were observed including a single record of the greater pipefish, *Syngnathus acus*.



SITE 7: RUDDERS MOORINGS

The area of the moorings comprised a mobile mixed substrate of pebbles and shell debris with Occasional sponges *Halichondria bowerbanki* and shredded carrot sponge, *Amphilectus fucorum*. Moorings made from concrete filled tractor tyres acted as artificial reefs and were covered in animal turf such as finger bryozoan, *Alcyonidium diaphanum*, sea squirt *Diplosoma listerianum* and a species characteristic of current-swept conditions, hornwrack, *Flustra foliacea*. Numerous empty oyster shells were found in the vicinity of the moorings. The slipper limpet, *Crepidula fornicata*, was notably Rare at this site. Large numbers of bottom dwelling fish were recorded including dragonet, *Callionymus lyra*, scorpion fishes and black goby, *Gobius niger*.



Old oyster shells DK



Gobius niger DK

SITE 8: WARRIOR

The survey area encompassed an area of wreckage and old, disused, pier piles. Boulders were found close to the shore and led down to a muddy slope to 12m depth. The muddy slope was covered in the slipper limpet, *Crepidula fornicata*, with Occasional anemones *Sargatia sp* and *Diadumene cincta*. The wreckage and other artificial structures were smothered in sponges, in particular Abundant breadcrumb sponge, *Halichondria panicea*. Hydroids included *Kirchenpaueria pinnata*, *Sarsia eximia*, *Sertularia argentea* and the helter-skelter hydroid, *Hydrallmania falcata*. The finger bryozoan, *Alcyonidium diaphanum*, was also Common with large sea lemons, *Doris pseudoargus*, and the hedgehog sea slug, *Acanthodoris pilosa*, present. Several species of crustaceans and benthic fish were found but in low numbers.

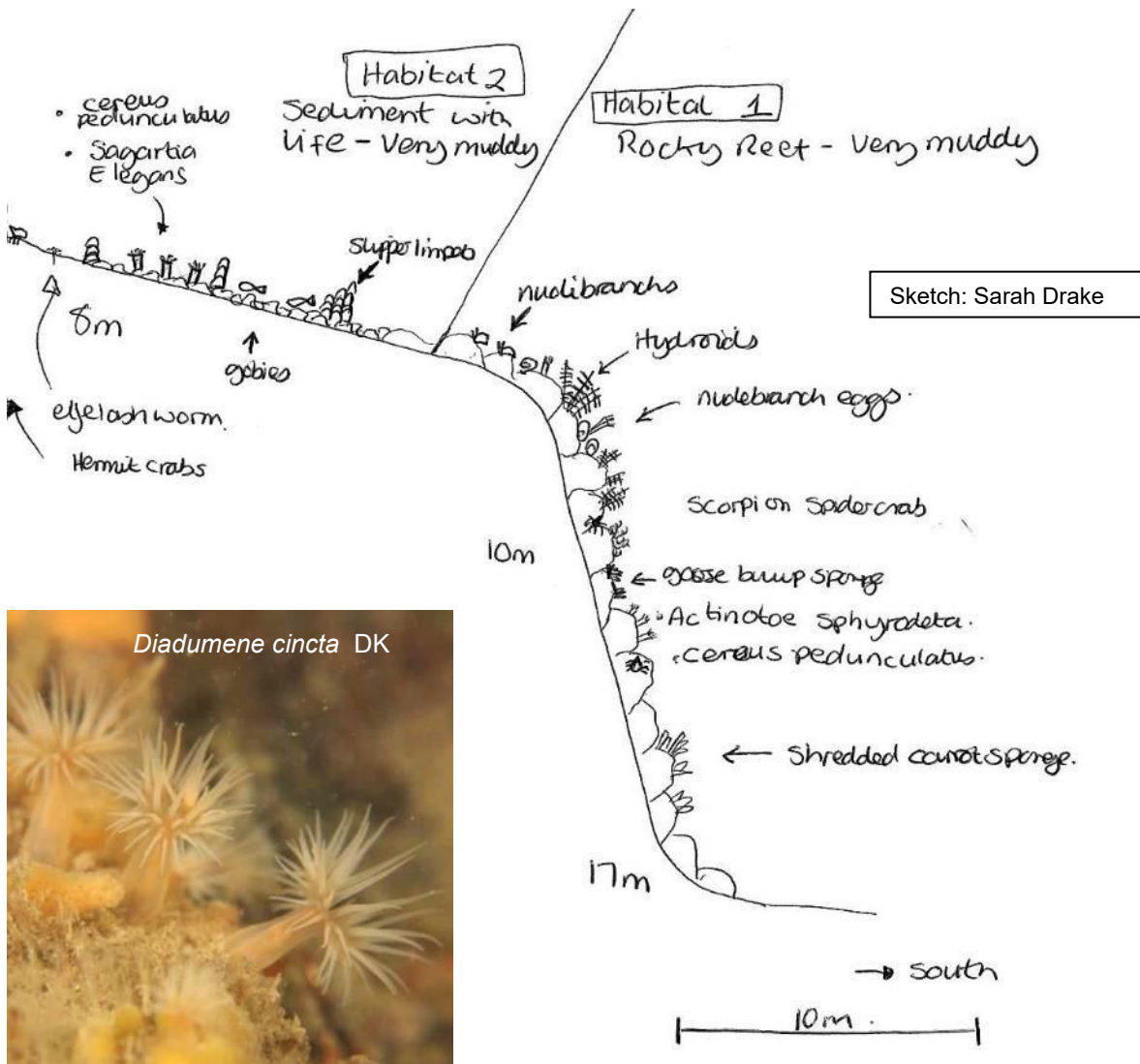


Hydrallmania falcata BB

SITE 9: NORTH CLEDDAU BRIDGE

This site was located a few metres west of the north end of the bridge. A steep bedrock wall was found between 8 and 15m depth. The rock face was thickly covered in silt and interspersed with pockets of cobbles and mud. Sponges and anemones dominated the rock faces. The goosebump sponge, *Dysidea fragilis*, was Common and the mermaid's glove, *Haliclona oculata*, breadcrumb sponge, *Halichondria panicea*, shredded carrot sponge, *Amphilectus fucorum*, and sea orange, *Suberites ficus*, were recorded as Frequent. The elegant anemone, *Sagartia elegans*, and the white striped anemone, *Actinotoe sphyrodeta*, were Frequent anemones but the anemone *Diadumene cincta* was also recorded hidden amongst the sponge turf. Six species of nudibranch were found, the most unusual being *Rostanga rubra*.

Shallower than 8m the seabed was more level, with a mix of angular pebbles and muddy shell gravel, where the slipper limpet *Crepidula fornicata* was Common.



SITE 10: BARNLAKE REEF

Located just west of the Cleddau bridge on the north side of the waterway, a shallow mud bank extended from the shore to 8m depth after which a 10m high, steep rocky wall extended to 18m where the seabed levelled off to form another muddy slope with slipper limpet, *Crepidula fornicata*, and shell debris. The steep rock wall was stepped with large rectangular blocks characterised by abundant sponge cover dominated by shredded carrot sponge, *Amphilectus fucorum*, mermaid's glove, *Haliclona oculata*, breadcrumb sponge, *Halichondria panacea*, and *Halichondria bowerbanki*. Where space allowed, a smattering of other sessile fauna was found, including white striped anemone, *Actinothoe sphyrodeta*, hydroid *Kirchenpaueria pinnata* and the bryozoan, *Bugula plumosa*. A variety of small goby species were found including the black goby *Gobius niger*. A nudibranch highlight was the nationally scarce *Thecacera pennigera*.



Actinothoe sphyrodeta DK

SITE 11: MAINPORT JETTY

The vertical pylons of the jetty extended to 8m depth and were covered in the plumose anemone, *Metridium dianthus*, and elegant anemone, *Sagartia elegans*, together with a mix of the fluted sea squirt, *Ascidiella aspersa*, and yellow sea squirt, *Ciona intestinalis*. Close to the base of the pylons was a thick covering of the sponge mermaid's purse, *Haliclona oculata*. Mixed seabed with boulders, mixed sediments and wreckage was found at the bottom, including three lost shellfish pots. All hard surfaces were covered in a mixture of sea squirts, sponges and anemones. Nudibranch species recorded included the sea lemon, *Doris pseudoargus*, the crystal sea slug, *Janolus cristatus*, and the painted balloon nudibranch, *Eubranchus tricolor*.



Sponge community KL

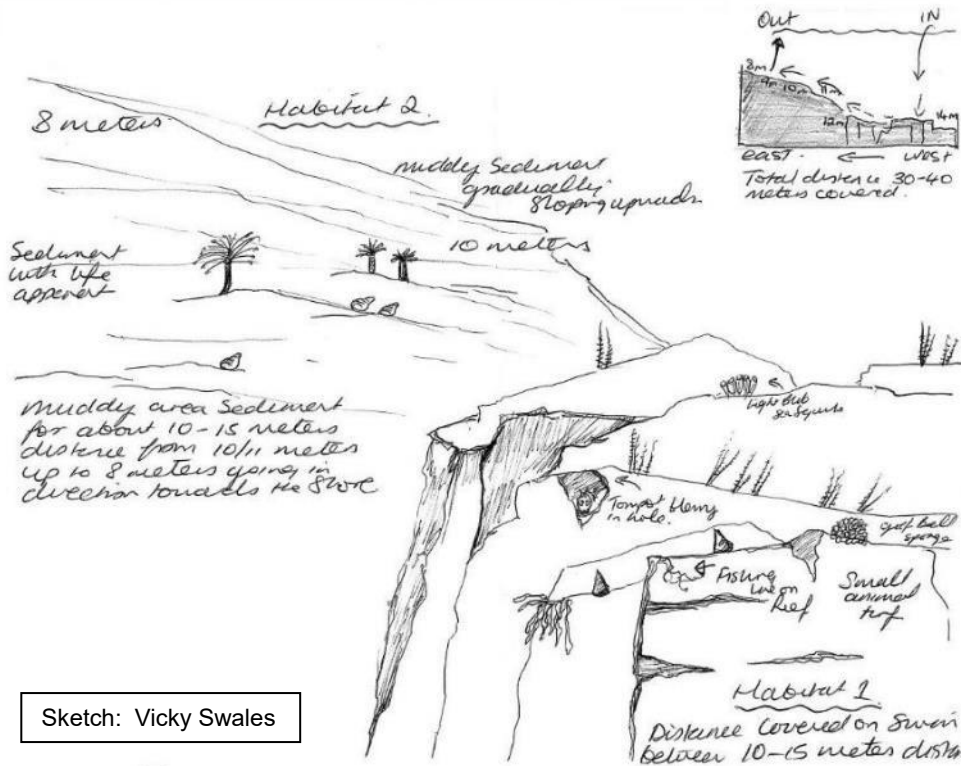


Eubranchus tricolor DK

SITE 12: MARTELLO REEF

Located just off the Mainport Jetty, the reef formed a gentle slope from 8m to 11m depth, with patches of muddy sediments supporting a scattering of marine life. Finger bryozoans, *Alcyonidium diaphanum*, were Common along with Occasional horn wrack, *Flustra foliacea*. The crystal sea slug, *Janolus cristatus*, and its egg masses was recorded as Frequent. Both dahlia anemone, *Urticina felina*, and burrowing anemone, *Cerianthus lloydii* were found along with velvet swimming crabs, *Necora puber*, and edible crab, *Cancer pagarus*.

Below this depth, the slope became a steep to vertical rock wall down to 14m depth. Anemones were Abundant and there was a dense, rich turf of sponges, hydroids and sea squirts. The bedrock was pitted and had large numbers of holes and cracks filled with fine soft sediment and silt. Anemones were dominated by plumose anemone, *Metridium dianthus*, and the elegant anemone, *Sagartia elegans*. The fluted sea squirt, *Ascidella aspera*, and yellow sea squirt *Ciona intestinalis*, were Abundant together with breadcrumb sponge, *Halichondria panicea*, and shredded carrot sponge, *Amphilectus fucorum*.



SITE 13: LLANDSTADWELL DROP OFF

An impressive 5-8m high bedrock wall drop off was located just outside of the mooring area. The wall was covered in sponges with the breadcrumb sponge, *Halichondria panicea*, being Superabundant together with mermaid's glove, *Haliclona oculata*, and goosebump sponge, *Dysidea fragilis*, which were both recorded as Common. Also Common were the oaten pipe hydroid, *Tubularia indivisa*, antenna hydroid, *Nemertesia antennina*, and *Nemertesia ramosa*. The site was rich in nudibranchs with both *Tritonia lineata* and *Coryphella browni* recorded as Frequent and a record of the nationally rare nudibranch *Trapania pallida*.



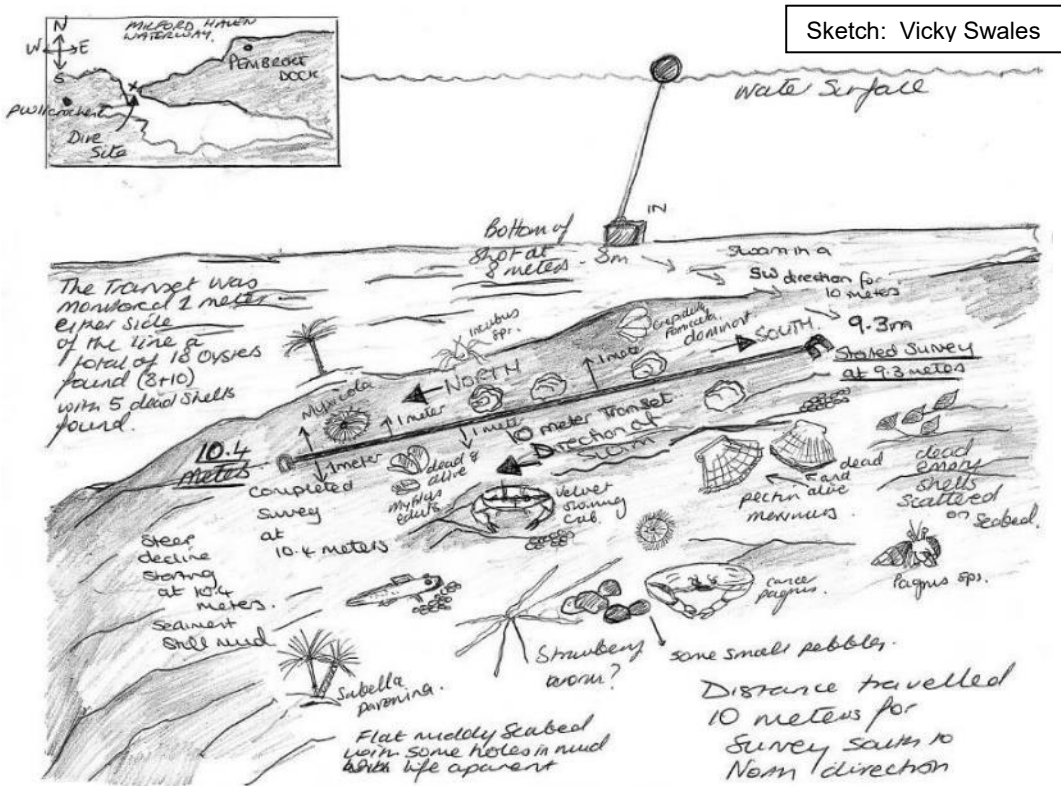
Coryphella browni DK



Dysidea fragalis DK

SITE 14. PENNAR GUT

A steep cobble slope covered in dense expanses of slipper limpet, *Crepidula fornicata*, led down to flat muddy areas with scattered pebbles, cobbles and broken shells. Attached to the pebbles were dense patches of shredded carrot sponge, *Amphilectus focorum*, large sea orange, *Suberites ficus*, and chocolate finger sponge, *Raspalia ramosa*. Interlaced amongst the sponges were antenna hydroids, *Nemertisia antennina*, and *N. ramosa* and nestled between the cobbles and broken shells were dahlia anemone, *Urticina felina* and daisy anemone, *Ceris pedunculatus*. In the muddy patches the eyelash worm, *Myxicola infundibulum*, strawberry worm, *Eupolyornia nebulosi*, and peacock worm, *Sabella pavonina*, were all recorded. Crustaceans included edible crab, *Cancer pagarus*, and Frequent velvet swimming crabs, *Necora puber*, and hermit crabs, *Pagarus bernhardus*.





Pagarus berhardus DK



Cancer pagarus DK

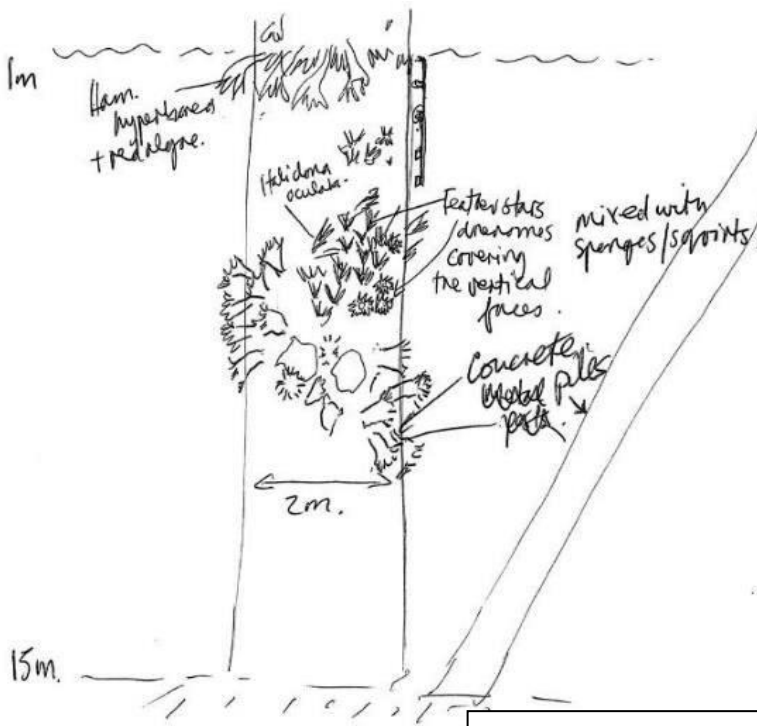
SITE 15. DRAGON LNG JETTY

Invasive and non-native species (INNS) recording was targeted on the jetty with boat charter provided by Dragon LNG.

The approximately one-metre diameter concrete piles supporting the jetty extended to about 15m depth. The near-surface half metre depth band was covered in forest kelp, *Laminaria hyperborea*, and red seaweeds. Below this the piles were covered by a thick carpet of feather stars, *Antedon bifida*, plumose anemone, *Metridium dianthus*, sponges and both solitary and colonial



Haliclona oculata and *Antedon bifida* SB



Sketch: Kate Lock



Metridium dianthus and *Amphilectus fucorum* BB

sea squirts. INNS recorded were leathery sea squirt, *Styela clava*, slipper limpet, *Crepidula fornicata*, orange tipped sea squirt, *Corella eumyota*, and Compass sea squirt, *Asterocarpa humilis*. Specimens of difficult to identify colonial sea squirts were collected and sent to the Marine Biological Association (MBA); it was confirmed that these did not include any invasive species.

SITE 16: PWLLCROCHAN

The survey site comprised a gently sloping expanse of muddy sediments with slipper limpet, *Crepidula fornicata*, forming a dense bed together with sea orange, *Suberites ficus*, fluted sea squirt, *Asciidiella aspersa*, red sea squirt, *Ascidia mentula*, and common whelks, *Buccinum undatum*. Sparse groups of hydroids, bryozoans and encrusting ascidians were recorded on small pebble and shell outcrops, including hermit crab fir, *Hydractinia echinata*, *Kirchenpaueria pinnata* and *Serturella gayii*. Large numbers of black gobies, *Gobius niger*, hermit crabs, *Pagurus bernhardus* and small spider crabs *Macropodia sp.* were also present



SITE 17: NEWTON NOYES JETTY

This disused jetty consists of cylindrical, vertical, cast iron piles linked by horizontal and cross struts. The entire structure was completely covered in a rich diversity of anemones, sponges, bryozoans and hydroids. High densities of feather stars, *Antedon bifida*, plumose anemone, *Metridium dianthus*, and elegant anemones, *Sagartia elegans*, were notable. Seven species of nudibranch were recorded including *Tritonia lineata* and *Jorunna tomentosa*. The seabed at the foot of the piles at 9m depth was a muddy substrate with mixed shell fragments covered in slipper limpets, *Crepidula fornicata*.



SITE 18: MILFORD DOCK MACKEREL STAGE

Concrete jetty piles were dominated by barnacles in the shallows and Superabundant fluted sea squirt, *Ascidia aspersa*, in the deeper parts. Common prawns, *Palaemon serratus*, and velvet swimming crabs, *Necora puber*, were found in cracks along the dock wall. Below the jetty piles and walls was a muddy sediment seabed, where tiny lobsters, *Homarus gammarus*, were found hiding in burrows.



Ascidia aspersa BB

SITE 19: LANDING CRAFT

The inverted wreck of a WW II landing craft is located between Angle Bay and Thorn Island. The wreckage was festooned in attached marine life. Plumose anemones, *Metridium dianthus*, and feather stars, *Antedon bifida*, were Superabundant and elegant anemones, *Sagartia elegans* were recorded as Abundant. Antenna hydroid, *Nemertesia antennina*, was Common with numerous painted balloon nudibranch *Eubranthus tricolor*. Common bryozoans included bryozoans, *Bugula plumosa*, *Scrupocellaria sp.* and white claw sea moss, *Crisia sp.* Nine species of sea squirt were recorded including the non-native species leathery sea squirt, *Styela clava* and orange sheath tunicate, *Botrylloides violaceus*.

The wreckage was surrounded by a sediment seabed of fine muddy sand with occasional broken shells. Horseman anemones, *Urticina eques*, velvet swimming crabs, *Necora puber* and numerous fan worms were observed but this area was not fully surveyed. Next to the wreck an old lost shellfish pot was found along with large coils of marine-life encrusted rope.

The site was surveyed in both 2010 and 2013. During the 2010 survey a particular highlight was the sighting of a minimum of six of the large nudibranch *Lomonotus genei*, with numerous egg coils.



Eubranthus tricolor DK



Lomonotus genei DK

SITE 20: ANGOR BUOY

The sediment seabed habitat comprised muddy sand mixed with shell gravel and large, old, broken oyster shells. Many burrows were recorded with angular crab, *Goneplax rhomboides*, present. Sparse sponge, hydroid, bryozoan and sea squirt species attached to the shells were all recorded as Occasional or Rare. Highlights of the survey were several records of the sea slug *Pleurobranchus membranaceus* which, unusually for a seaslug, is notable for its swimming ability as well as its typically large size, and a photographed sighting of a hermit crab *Pagarus prideaux* that had evacuated its shell covered in a cloaked anemone, *Adamsia palliata*. King scallops, *Pecten maximus*, and queen scallops, *Aequipecten opercularis*, were also recorded.



Pagarus prideaux DK



Adamsia palliata DK

SITE 21: STACK ROCK

This island is located in the centre of the lower Milford Haven waterway close to the main shipping channel. A fort is situated on the island and the rocks are a haul-out site for grey seal *Halichoerus grypus*.

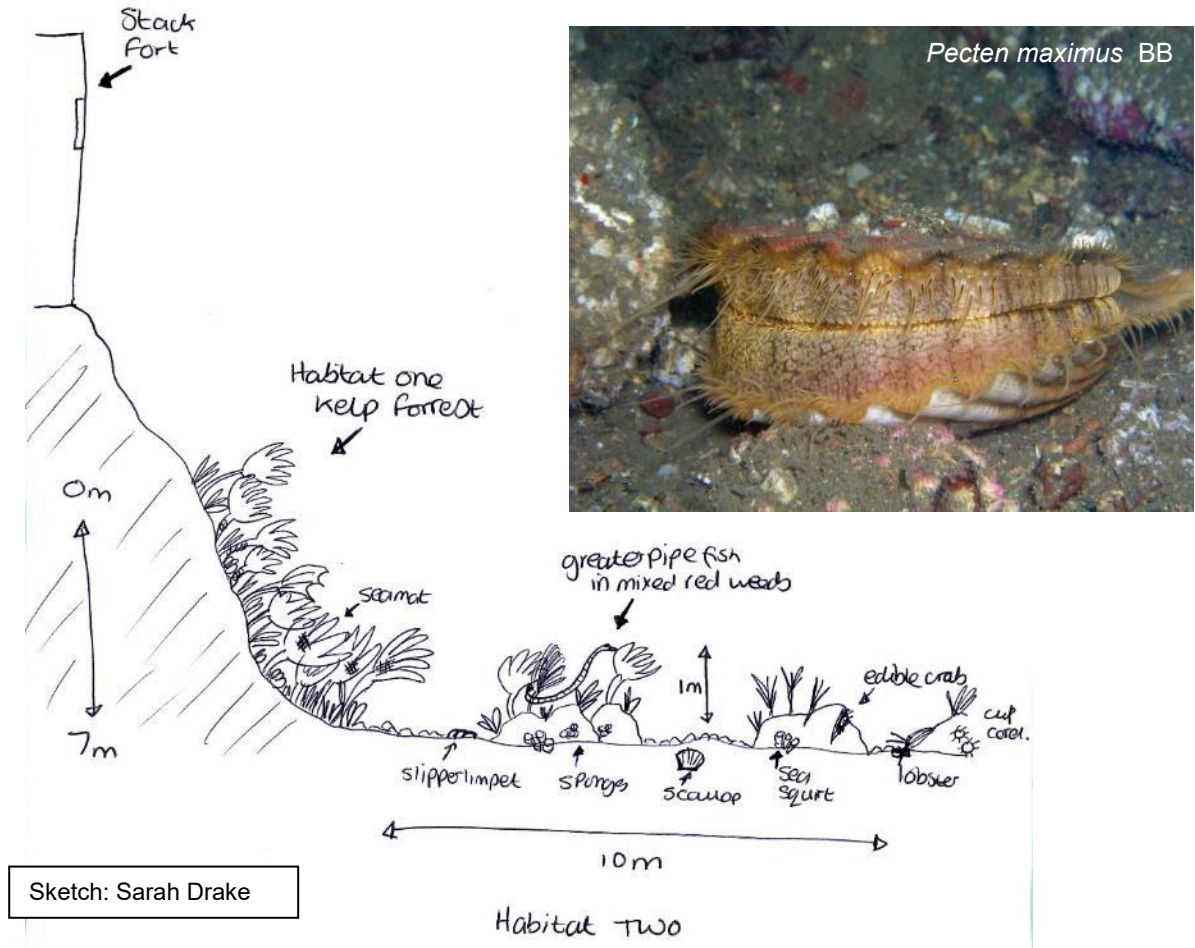
Outcrops of low-lying rocky reef were dominated by luxuriant red algal turf and short vertical faces with bryozoans and sea squirts. The non-native leathery sea squirt *Styela clava* was frequently recorded. Other sea squirts included gas lantern sea squirt, *Corella*

parallelogramma, and sand encrusted sea squirt *Synoicum incrustatum*. Crabs favoured the habitat with seven species being found, territorial fish included dragonets, *Callionymus lyra*, tompot blenny, *Parablennius gattorugine* and long-spined scorpion fish, *Taurulus bubalis*. Notable nudibranch species were *Palio nothus* and *Thecacera pinnagera*.

The reef was surrounded by sediment of fine sand and shell with burrowing anemones including the daisy anemone, *Cereus pedunculatus*, and king scallops, *Pecten maximus*.

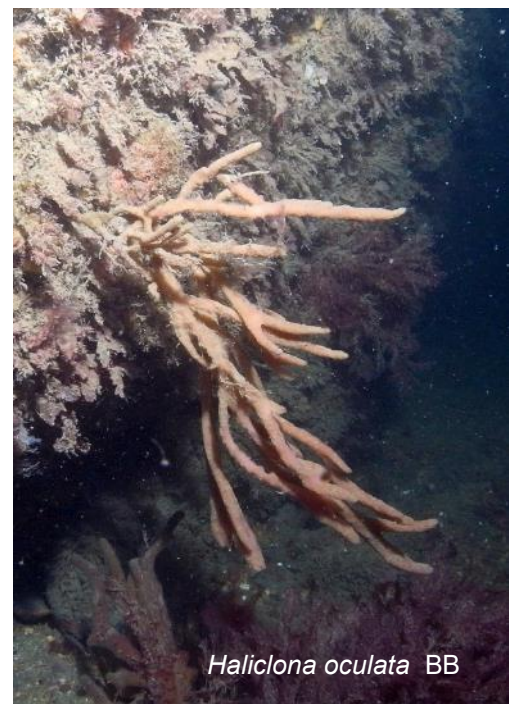


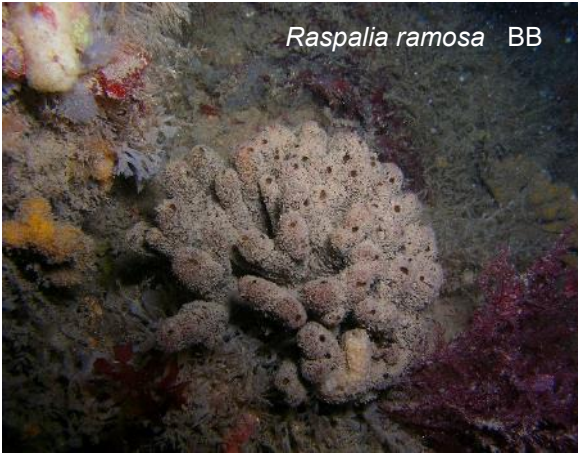
Cancer pagarus BB



SITE 22: WEST STACK ROCK

A series of low, broken and irregular bedrock ridges interspersed with sandy gravel sediments extended a considerable distance west from Stack Rock, until they met a sediment plain at around 10m depth. Upward facing rock surfaces were richly covered in red algae. Ascidians and sponges dominated the vertical rock faces with the gooseberry sea squirt, *Dendrodoa grossularia*, and the yellow boring sponge, *Cliona celata*, recorded as Common. Erect sponges included the chocolate finger sponge, *Raspalia ramosa*, mermaids glove, *Haliclona oculata* and the yellow staghorn sponge, *Axinella dissimilis*. The chimney sponge, *Polymastia penicillus*, was also found in sediment covered areas between rock ridges.





The sediment areas comprised pebbles, shell fragments and cobbles mixed with fine sand. These were rich in burrowing and tube-dwelling species including the burrowing anemone *Cerianthus lloydii* and daisy anemone, *Cereus pedunculatus*, together with the eyelash worm, *Myxicola infundibulum*, and the feather duster worm, *Sabella pavonina*. King scallops, *Pecten maximus*, were recorded and evidence of fishing dredge tracks were observed on the sediment plain. The non-native species leathery sea squirt, *Styela clava*, and slipper limpet, *Crepidula fornicata*, were recorded.

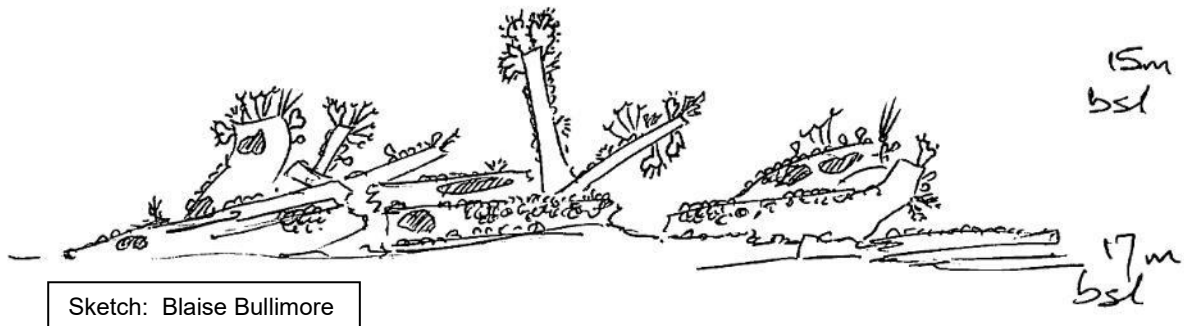
Sketch: Blaise Bullimore



SITE 23: STACK BUOY WRECK

The survey site comprised widespread wreckage of broken, flat steel plates with protruding spars and bars covered in a thick layer of silt. Animal life found on the silt covered, upward facing, horizontal surfaces was sparse with small patches of pinhead sea squirts, *Pycnoclavella stolonialis* and *P. aurilucens* and club sea squirt, *Aplidium punctum* recorded. Bryozoan species included *Chartella papyracea*, finger bryozoan, *Alcyonidium diaphanum*, and Occasional potato crisp bryozoan, *Pentapora foliacea*. A record of a single common sunstar, *Crossaster papposus*, was notable.

Dead men's fingers, *Alcyonium digitatum*, and oaten pipe hydroids, *Tubularia indivisa* were recorded on the higher points of the wreckage where they were most exposed to the tidal currents. A conger eel, *Conger conger*, was recorded amongst the wreckage and four lost, ghost-fishing, shellfish pots with lobster and edible crabs present inside were found.



Sketch: Blaise Bullimore



Tubularia sp and Sagartia elegans BB



Lost shellfish pot BB

SITE 24: SANDY HAVEN REEFS

Two adjacent sites, Montreal Reef and Moon Pinnacles, were surveyed. Both were isolated rock outcrops rising two to three metres above the surrounding sediment of sand and gravel at 8m depth. The tops of the reef were covered in silty red algae and sparse kelp forest, a combination of forest kelp, *Laminaria hyperborea*, and furbellows, *Saccorhiza polyschides*. The rock faces were densely covered in colonial ascidians, dense clumps of the orange sea grapes, *Stolonica socialis*, and the sponge seasquirt, *Diplosoma spongiforme* being commonest. A diverse range of sponge and bryozoan species were found with finger bryozoan, *Alcyonidium diaphanum* Common. The blue striped squat lobster, *Galathea strigosa*, velvet swimming crab, *Necora puber*, and common prawn, *Palaemon serratus*, were all found hiding in rock crevices. Several wrasse species were recorded swimming around the reef whilst tompot blenny, *Parablennius gattorugine*, and conger eel, *Conger conger*, were found in holes between boulders.



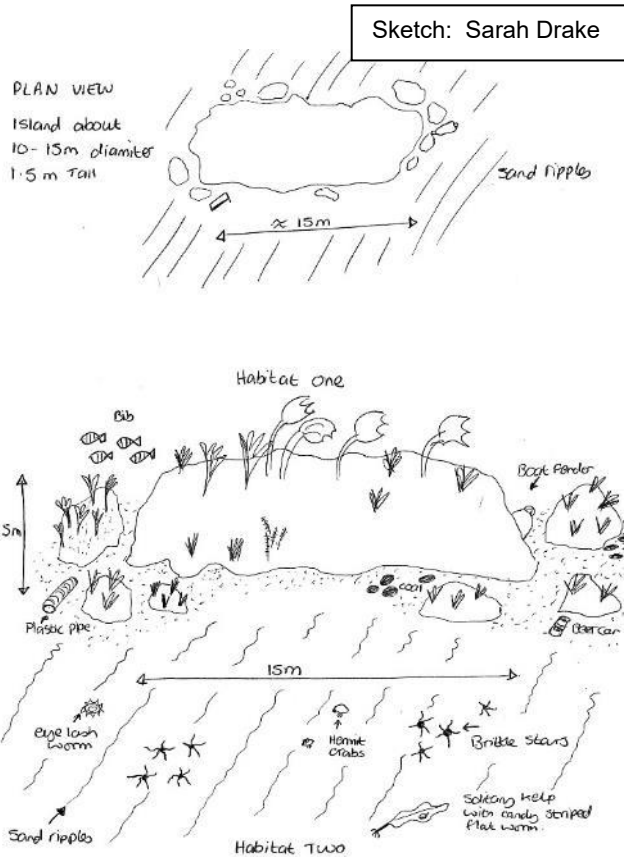
Stolonica socialis BB



Necora puber and *Raspalia ramosa* CW



Phoronis hippocrepia SB



SITE 25: LONGOAR BAY

This site was surveyed in 2010 as part of a CCW volunteer diving survey organised by Marine Ecological Solutions Ltd to map the eelgrass *Zostera marina* known to be present. Within the shallow bay, the intertidal rocks led down to a seabed of fine sand with worm casts, gobies and shore crabs. Dense and healthy stands of eelgrass were recorded between two and four metres depth in a band approximately 30m wide.

East of the eelgrass bed at 4m depth, cobbles and pebbles with mixed broken shells were found covered in brown algae including sugar kelp, *Saccharina latissima*. Within the *Zostera marina* bed were snakelocks anemones, *Anemonia viridis*, and daisy anemones, *Ceris pedunculatus*. Feather duster worms, *Sabella pavonina* were Common and sea hares, *Aplysia punctata*, Frequent. Two species of stalked jellyfish attached to the eelgrass, *Haliclystus octoradiatus* and *Lucernariopsis campanulata* were notable records.



Haliclystus octoradiatus SB



Sabella pavonina DK

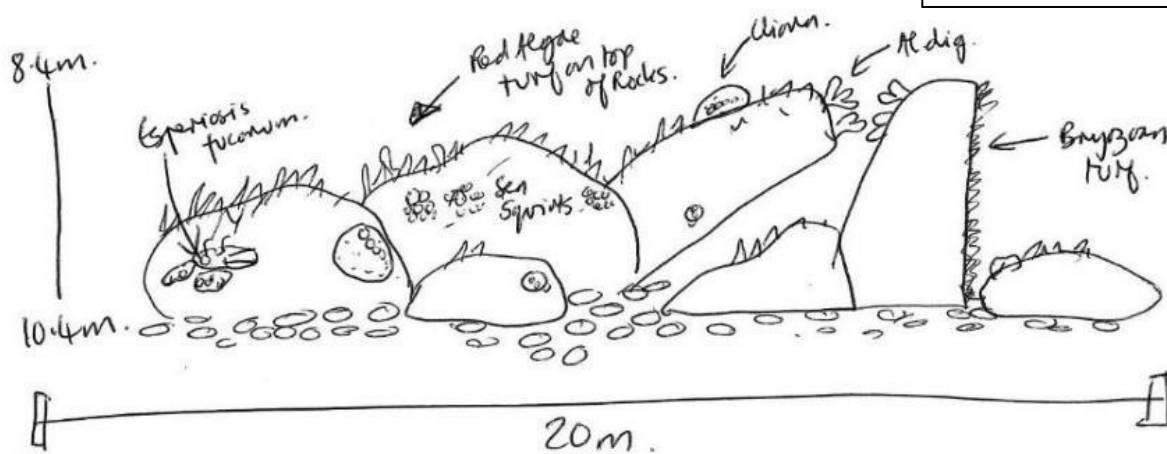
SITE 26: GREAT CASTLE HEAD

The bedrock reef of Old Red Sandstone which extends south from the end of the headland was characterised by ridges and gullies before it gradually flattened out to meet a cobble and pebble seabed at about 10m depth.

The rocks were festooned with bryozoan and sea squirt species, particularly orange sea grapes, *Stolonica socialis*, finger bryozoan, *Alcyonidium diaphanum*, and bryozoans *Chartella papyracea*, *Bugula turbinata* and *B. plumosa*. A wide diversity of sponge species was found with 13 species recorded including large colonies of shredded carrot sponge, *Amphilectus fucorum*, chocolate finger sponge, *Raspalia ramosa*, and branching sponge, *Stelligera stuposa*. The occurrence of nationally scarce sponge *Axinella damicornis* was notable.

The small number of scarlet and gold cup coral, *Balanophyllia regia*, recorded in a gully was the first record for this nationally scarce species in Milford Haven.

Sketch: Kate Lock



SITE 27: LITTLE CASTLE HEAD

The habitats and species on this small headland in Sandy Haven bay were very similar to those at Great Castle Head (site 26), except that the reef tops were covered in a thick kelp forest with a dense turf of red algae. Sea squirt and sponge species were found amongst the algae and on the small vertical faces on the edges of the reef. Breadcrumb sponge, *Halichondria panacea*, and shredded carrot sponge, *Amphilectus fucorum*, were both Common together with orange sea squirt, *Stolonica solcialis*, and star sea squirt, *Botryllus schlosseri*. Non-native leathery sea squirt, *Styela clava*, and the nationally scarce sponge *Axinella damicornis* were notable records. Cobbles and coarse sand were found in gullies between the ridges of rock that extended out from the headland.



Stolonica solcialis CW



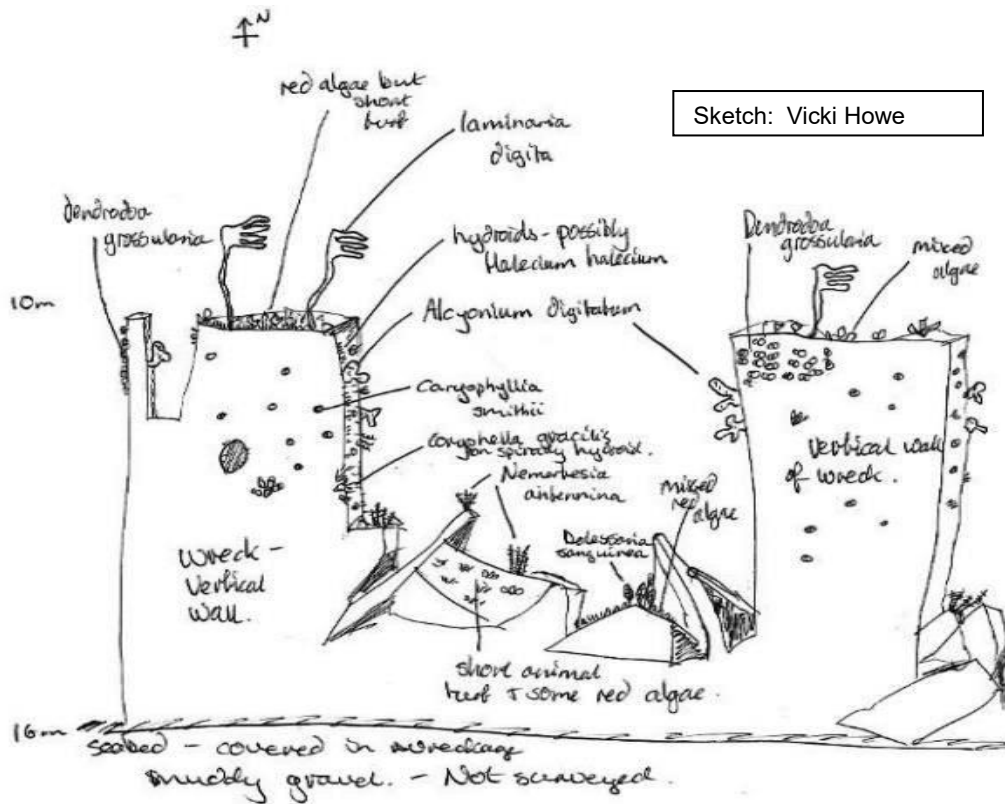
Kelp forest KL

SITE 28: BEHAR WRECK

The wreck of the Behar lies offshore between Little Castle and Great Castle Heads. Although the wreck is very broken up there are remain many vertical and steep faces colonised by animal life. Deadman’s fingers, *Alcyonium digitatum*, were found attached to the wreck together with oaten pipe hydroid, *Tubularia indivisa*, the shredded carrot sponge, *Amphilectus fucorum*, and large patches of gooseberry sea squirt, *Dendrodoa grossularia*. Ballan wrasse, *Labrus bergylta*, and goldsinny wrasse, *Ctenolabrus rupestris*, brown crabs, *Cancer pagarus*, and common lobster, *Homarus gammarus*, were all found sheltering in the wreckage.



Tubularia indivisa BB



SITE 29: THOR WRECK

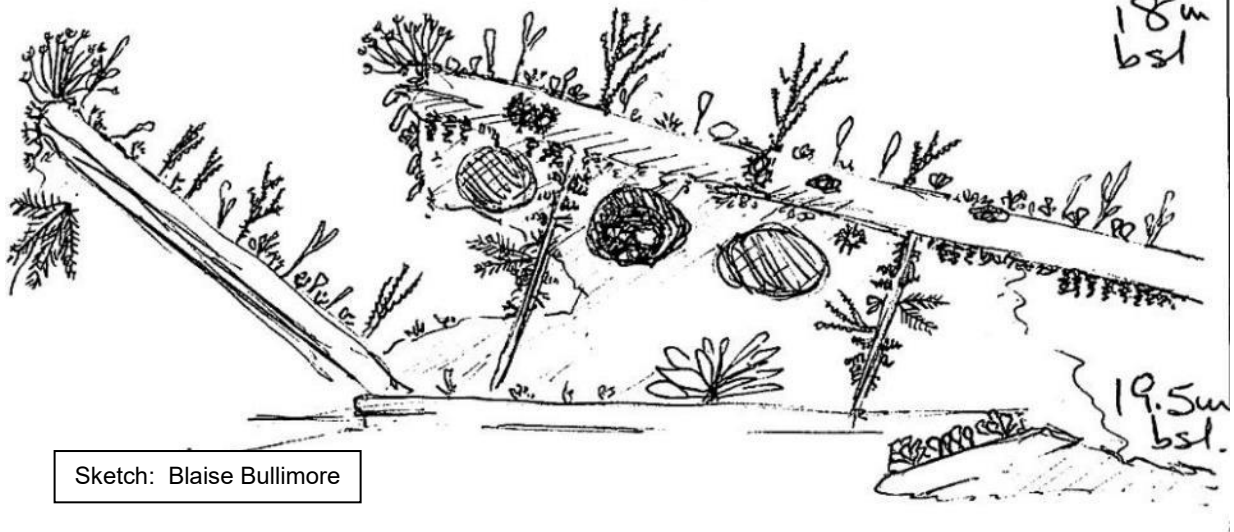
The Thor wreck is mostly reduced to large, broken, largely horizontal steel plates with some remains of the hull structure on a sediment seabed at 20m depth. Upward faces of wreckage was covered in thick silt and dominated by an abundance of finger bryozoans, *Alcyonidium diaphanum*. Erect hydroids were recorded as Frequent, in particular the antenna hydroid, *Nemertesia antennina*. Devonshire cup corals, *Caryophyllia smithii*, and small cushion sponges including spiky lace sponge *Leucosolenia lacunosa* were also recorded as Frequent. A wide variety of bryozoans were found on overhanging and edges of the wreck's structure, including *Scrupocellaria sp*, *Bicellaria sp* and spiral brozoan, *Bugula sp* along with the elegant anemone, *Sagartia elegans*, and colonial sea squirts. Small shoals of bib, *Trisopterus luscus*, were present around the wreckage. The notable nudibranch species *Palio nothus* and *Ancula gibbosa* were recorded.



Palio nothus BB



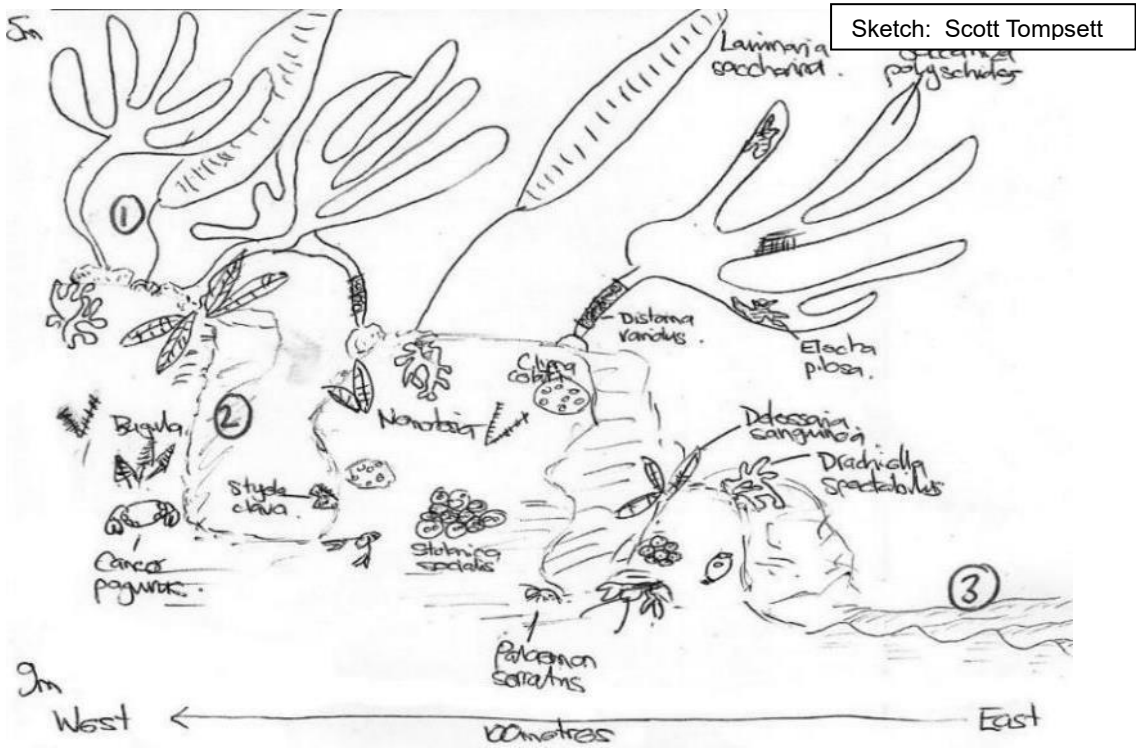
Leucosolenia lacunosa DK



Sketch: Blaise Bullimore

SITE 30: CHESTER POINT

The survey site was an area of shallow reef between five and eight metres depth with a dense kelp forest of furbelows, *Saccorhiza polyschides*, and sugar kelp, *Saccharina latissima*. Gullies with two metre high faces ran in a north - south direction and were covered in red algae, sponges, bryozoans and sea squirts, in particular orange sea grapes, *Stolonica socialis*, star sea squirt, *Botryllus schlosseri*, and baked bean sea squirt, *Distomus variolosus*. The shredded carrot sponge, *Amphilectus fucorum*, and bread crumb sponge, *Halichondria panacea*, were both Common along with Devonshire cup corals, *Caryophyllia smithii* and antenna hydroid, *Nemertesia antennina*. The bottom of the gullies were filled with coarse barren sand.

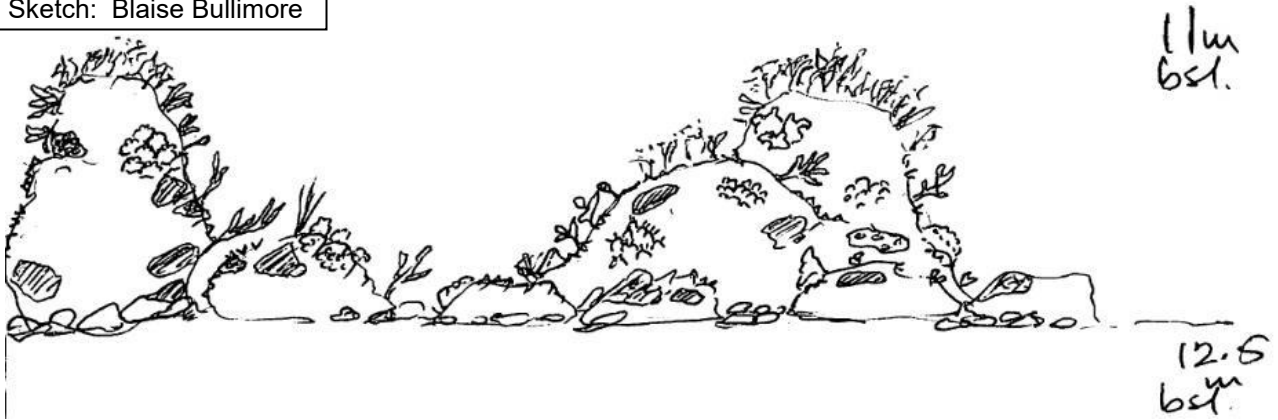


Sketch: Scott Tompsett

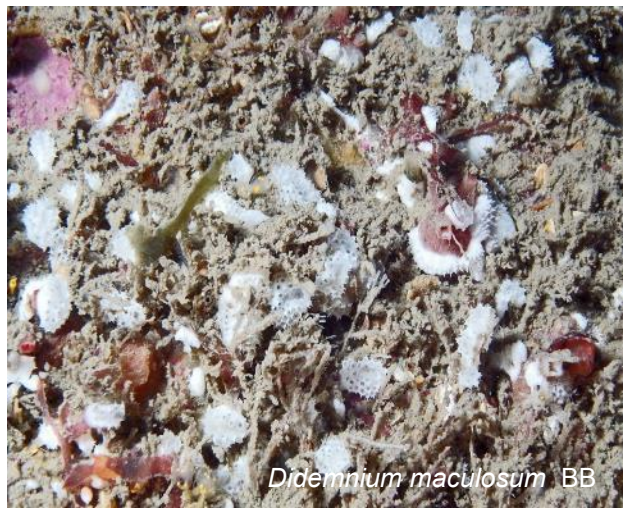
SITE 31: LINDSWAY REEF

Small outcrops of rocky reef were surveyed at 13m depth, each of which rose about a metre above a coarse sand seabed. The rocks were covered in a mixture of red algae and animal turf, mainly sponge and sea squirt species. Common sponges included the elephant's ear sponge, *Pachymatisma johnstonia*, and the yellow staghorn sponge *Axinella dissimilis*; less frequent were chimney sponge *Polymastia penicillus* and mashed potato sponge *Thymosia gurnei*. Sea squirts were dominated by the orange sea grapes, *Stolonica socialis*, together with the snowflake sea squirt, *Didemnum maculosum*, and the strawberry sea squirt, *Aplidium* sp. Common lobster *Homarus gammarus*, along with velvet swimming crabs, *Necora puber*, and brown crabs, *Cancer pagurus*, were present around the reefs together with Abundant double spiral tube worm, *Bispira voluntacornis*. Several fish species were recorded as Frequent and, notably, amongst the boulders was a small juvenile crawfish, *Palinurus elephas*.

Sketch: Blaise Bullimore



Sponge communities BB



Didemnum maculosum BB

SITE 32: WATCH HOUSE POINT

The survey site comprised closely packed large boulders with overhangs and fissures at 11m depth. Kelp park and algae heavily encrusted in white clawed sea moss, *Crisia* sp, were recorded in the shallows, with grazing sea urchins, *Echinus esculentus*. Sea squirt species included red sea squirt, *Ascidia mentula*, fluted sea squirt, *Ascidiella aspersa*, densely packed gooseberry sea squirt *Dendrodoa grossularia* and the non-native leathery sea squirt *Styela clava*. The double spiral tube worm, *Bispira volutacornis*, was Common amongst the boulders. Both common prawns, *Palaemon serratus*, and velvet swimming crabs, *Necora puber*, were found along with one large crawfish *Palinurus elephas*.



Dendrodoa grossularia DK

SITE 33: MONK HAVEN POINT

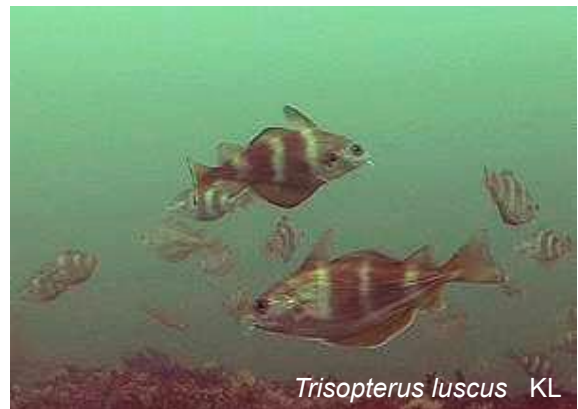
A gently sloping reef with boulder filled gullies and sand gravel patches was surveyed. Both reef and boulders were covered with dense red algae, amongst which were Abundant snakelocks anemones, *Anemonia viridis*. Although in low abundance, a diverse range of sponge, sea squirt and bryozoan species were found including horn wrack, *Flustra foliacea*. Notable records included Abundant spindly spider crabs of both *Inacus spp* and *Macropodia spp* and Abundant double spiral worm, *Bispira volutacornis*.



Inacus spp DK

SITE 34: CAROLINE WRECK

The wreckage of a small converted fishing boat is located close to the much larger wreck of the Dakotian (site 35). Pollack, *Pollachius pollachius*, and bib, *Trisopterus luscus*, were recorded shoaling around the wreck, whilst tompot blenny, *Parablennius gattorugine*, long-spined sea scorpion, *Taurulus bubalis* and lobsters, *Homarus gammarus*, were hidden amongst the wreckage. Short animal turf was attached to the more vertical wreck plates including antenna hydroids, *Nemertesia antennina* and Devonshire cup-coral, *Caryophyllia smithi*. Notable too was the presence of potato crisp bryozoan, *Pentapora foliacea*.



Trisopterus luscus KL

SITE 35: DAKOTIAN WRECK

Located east of Dale Point, the bows, the most intact section of the wreck, and broken parts of wreckage are spread over a large area. Angling over the wreck is popular and as a result large amounts of fishing line and lures are frequently found tangled in the wreckage.

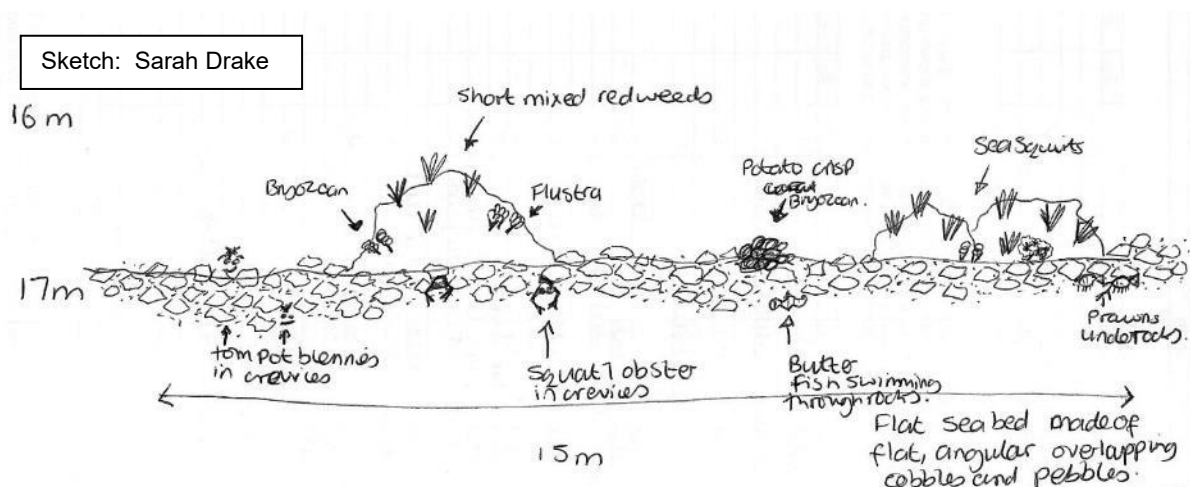
Red algae covered the shallowest upward facing surfaces whilst the steeper sides were covered in Devonshire cup coral, *Caryophyllia smithii*, fried egg anemone, *Actinothoe sphyrodeta*, dead men's fingers, *Alcyonium digitatum* and jewel anemones, *Corynactis viridis*. Common too were finger bryozoans, *Alycyonidium diaphanum*, whilst yellow staghorn sponge, *Axinella dissimilis*, and sea orange, *Suberites ficus*, were both recorded as Occasional. Shoals of juvenile pollack, *Pollachius pollachius* were noted swimming around the wreck and both ballan wrasse, *Labrus bergylta*, and cuckoo wrasse, *Labrus mixtus*, were recorded.

SITE 36: DAKOTIAN EAST REEF

The survey site was a flat seabed of angular cobbles with occasional small boulders and areas of low bedrock rising a half metre above the surrounding area of mixed sediment composed of pebbles, gravel and coarse sand.



The rocks were lightly silt covered with sparse red algae and encrusting bryozoans. The potato crisp bryozoan, *Pentapora foliacea*, was Occasional together with Frequent orange pumice bryozoan, *Cellepora pumicosa*. A diverse range of territorial fish were observed including rock and black gobies, *Gobius paganellus* and *Gobius niger*, the long-spined scorpion fish, *Taurulus bubalis*, and the common reef wrasses goldsinny, *Ctenolabrus rupestris*, and corkwing, *Crenilabrus melops*. The most notable feature of sediment habitat was the presence of large numbers of the long clawed squat lobsters, *Munida rugosa*, found in shallow burrows and King scallops, *Pecten maximus* lying on the coarse sand.



SITE 37: WATWICK POINT

A reef of low irregular bedrock between 14 and 16m depth with gullies in a north–south orientation and filled with small boulders interspersed with sand was surveyed.

The reef tops were dominated by red algal meadows intermingled with a rich diversity of animals. The massive sponges elephants hide sponge, *Pachymatisma johnstonia*, and yellow boring sponge, *Cliona celata*, were both present along with the yellow staghorn sponge, *Axinella dissimilis* and spiky lace sponge *Leucosolenia lacunosa*. The potato crisp bryozoan, *Pentapora foliacea*, and orange pumice byozoan, *Cellepora pumicosa*, were both recorded as Frequent. Sea squirts included large patches of orange sea grapes, *Stolonica socialis*, snowflake sea squirt, *Didemnum maculosum*, strawberry sea squirt *Aplidium sp*, and pinhead sea squirt *Pycnoclavella stolonialis*.



Shoals of bib, *Trisopterus luscus*, were Common, corkwing, *Crenilabrus melops*, goldsinny, *Ctenolabrus rupestris* and ballan *Labrus bergylta*, wrasses, were all recorded. A small, less than 30cm length, juvenile spotted catshark, *Scyliorhinus canicula*, and a blonde ray, *Raja microcellata* were sighted. Several species of nudibranch were recorded with *Favorinus blianus* and *Thecacera pennigera* being the highlights.

At 13m the reef gave way to a flat plain of mixed sediments including cobbles, pebbles, gravel and sandy patches with king scallops, *Pecten maximus*. Within Watwick Bay, close to Watwick Point, the scattered remains of the wreck of a submarine acts as an artificial reef supporting a similar range of marine wildlife as the adjacent rock reef.

Sketch: Blaise Bullimore



SITE 38: WEST BLOCKHOUSE

Below the West Blockhouse, a rocky reef extends from 8 to 12m depth leading down to a mixed sediment seabed. The tops of the reef were covered in kelp park of forest kelp, *Laminaria hyperborea*, and red algal meadows. Interspersed amongst the algae were patches of orange sea squirts, *Stolonica socialis*, star sea squirt, *Botryllus schlosseri*, and large yellow boring sponge, *Cliona celata*. The yellow staghorn sponge, *Axinella dissimilis*, and chimney sponge, *Polymastia penicillus*, were both recorded. Several crustacean species were found including the long clawed squat lobster, *Munida rugosa*, and great spider crab, *Hyas araneus*. In the sediment areas the feather duster worm, *Sabella pavonina*, sand mason worm, *Lanice conchilega*, and razor clams, *Ensis sp.* were found along with dragonets, *Callionymus lyra*.



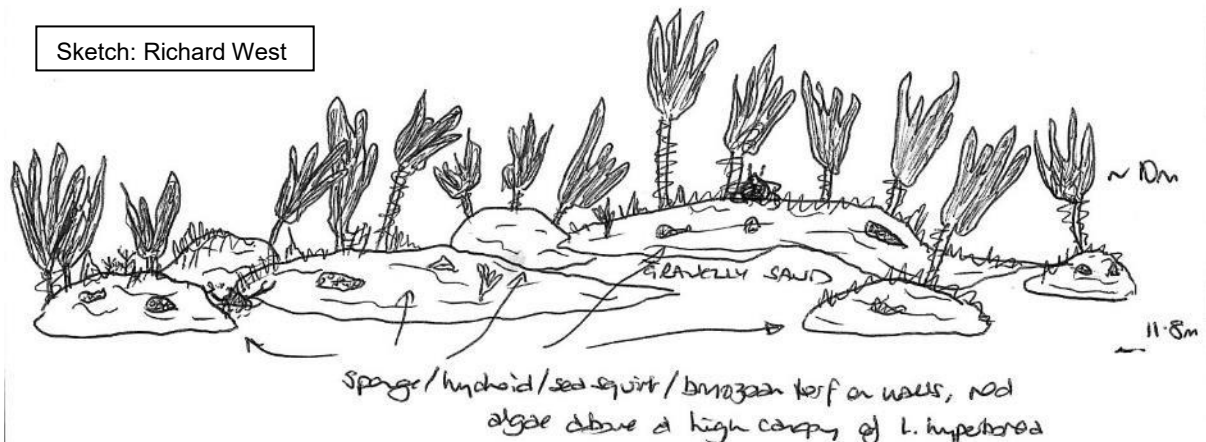
Axinella dissimilis BB

SITE 39: MILL BAY

A low-lying reef extending to 12m depth, with gravel and sand filled gullies, was surveyed. Upward facing rock surfaces were covered in kelp park and red algae, with hydroid, sponge and bryozoan species attached to the kelp stipes and other rock surfaces. The yellow staghorn sponge, *Axinella dissimilis*, and chimney sponge, *Ciocalypta penicillus*, were both recorded along with clusters of hornwrack, *Flustra foliacea*. Common sea urchins, *Echinus esculentus*, were recorded together with a variety of starfish including bloody henry, *Henricia oculata*, and spiny starfish, *Marthasterias glacialis*.



Ciocalypta penicillus EW



SITE 40: WEST CHAPEL BAY, THORN ISLAND

An irregular area of reef with a steep – vertical, two metre high, rock face above boulders and cobbles at 10m, which led to a fine muddy sediment seabed, was surveyed. Kelp park and thick red algae covered the rocks to 8m depth and deeper than this rock faces were covered in bryozoans and sea squirts, including large patches of gooseberry sea squirt, *Dendrodoa grossularia* and Frequent white claw sea moss, *Crisia sp.* The non-native leathery sea squirt, *Styela clava*, was recorded. Fishes and crustaceans were active in the rocky reef and boulder areas with common prawns, *Palaemon serratus*, found in narrow rock crevices and angular crabs, *Goneplax rhomboides*, creating burrows in the muddy sediments.



SITE 41: LOCHSHEIL WRECK

The “whiskey wreck” is located very close to Thorn Island and lies on a bed of mixed sand and gravel. It is very broken up and dispersed wreckage is distributed close to the island in around 12m depth. A full survey of the wreck has not been completed but initial findings recorded silt covered plates with Devonshire cup-corals, *Caryophyllia smithii*, and reasonably large numbers of fish including ballan wrasse, *Labrus bergylta*, pollack, *Pollachius pollachius*, and leopard spotted goby, *Thorogobius ephippiatus*.

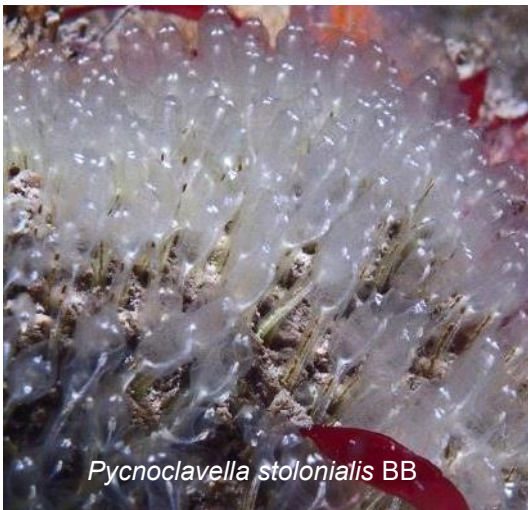
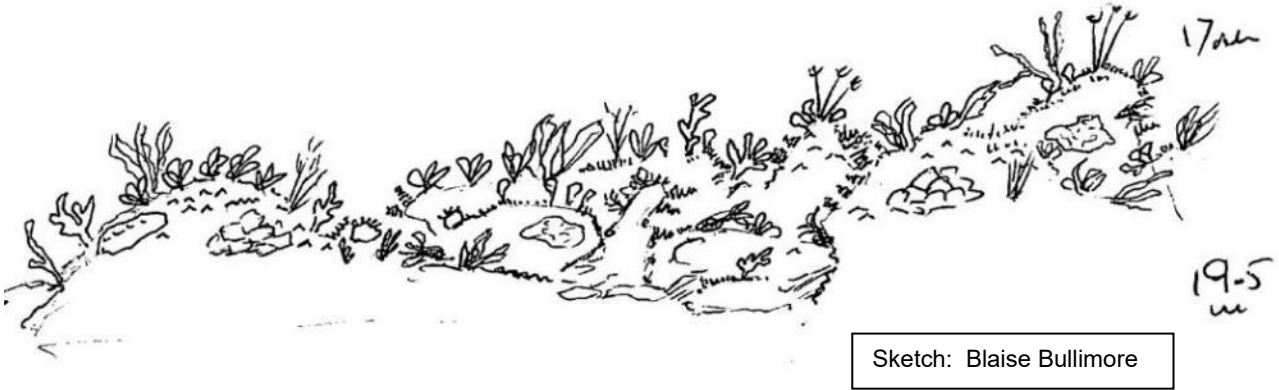
SITE 42: RAT ISLAND REEFS

An extensive area of reefs extends between Rat and Sheep Islands. Several sites immediately south of Rat Island were surveyed, each of which consisted of one to two metre high, parallel bedrock ridges with cobbles in the gullies between the ridges.

Mixed red algae and animal turf covered rock surfaces and the sponge and sea squirt communities were particularly rich. There was a diverse range of sponges with 15 species recorded, notable records being the staghorn sponge, *Axinella dissimilis*, brain sponge, *Axinella damicornis*, prawn-cracker sponge, *Axinella infundibiformis* and mashed potato sponge, *Thymosia guernei*. Notable sea squirts included the red sea squirt *Didemnum pseudofulgens*, only recorded from a small number of sites in Wales, the pin head sea squirts, *Pynoclavella aurilucens* and *P. stolonialis*, and the non-native leathery sea squirt, *Styela clava*. Dragonets, *Callionymus lyra*, and tompot blennies, *Parablennius gattorugine*, were found in the gullies and both common lobster, *Homarus gammarus*, and a crawfish *Palinurus elephas*, were recorded.



A nudibranch highlight was a record of the nationally scarce *Thecacera pennigera*.



SITE 43: SHEEP ISLAND

Survey dives were completed on the north side of the island in Castles Bay. Sites comprised fields of large boulders covered in a kelp park down to 13m depth and a carpet of dense red algae from 13 to 16m depth. The red algae were dominated by Abundant red fringe weed, *Calliblepharis ciliata*. Amongst the algae were small patches of sponges including the brain sponge *Axinella damicornis*. Very few fish were recorded but crustaceans included common lobster, *Homarus gammarus*, blue striped squat lobster, *Galathea strigosa*, and Abundant common prawn, *Palaemon serratus*.



4. CONCLUSIONS

The Seasearch records collected during the 12 years of surveys, have generated substantial additional habitat and species data, providing additional evidence of Milford Haven's great biological richness and diversity. The strong currents, large tidal range, varying shelter from wave action and freshwater input creates a unique mix of environmental conditions that allow many species to thrive.

Throughout the waterway, surveyed habitats varied from muddy mixed sediments to steep or extensive rocky reefs. Muddy pebble seabeds with cobbles and small boulders were rich in sponges, anemones, crabs and fish. Although native oysters, *Ostrea edulis* were scattered throughout the middle and upper waterway, many sites were dominated by non-native slipper limpets, *Crepidula fornicata*, which compete for food and space with oysters.

Rocky reefs rich in sea squirts and sponges extend far inland into the Daugleddau. Reefs were particularly rich in densely packed and massive growths of sponges, especially shredded carrot sponge, *Amphilectus focorum*, mermaids glove, *Haliclona oculata* and breadcrumb sponge, *Halichondria panicea*.

The wrecks surveyed in the lower Haven generally supported both schooling fish, such as pollack and bib, and territorial fish using the wreckage as refuges. Whilst upward facing steel plates were frequently covered in thick silt, some supported dense stands of red algae or the annually growing finger bryozoan *Alcyonidium diaphanum*. However, steep, vertical and overhanging surfaces were often home to the oaten pipe hydroid, *Tubularia indivisa*, and deadman's fingers, *Alcyonium digitatum*.

The Seasearch surveys have also generated added value by recording and providing particularly useful new information on the presence and location of priority species and habitats, non-native and invasive species and notable species.

Effective partnership working between Seasearch, Natural Resources Wales marine staff, the Pembrokeshire Marine SAC Officer and the MHWESG project manager has enabled the surveys to target areas productively. The species and habitat data collected and the considerable collection of digital images stored are available to support management planning and assessment of proposed developments for the area.

Diving conditions in the Cleddau estuaries and Milford Haven Waterway are challenging and careful dive planning is needed. Poor underwater visibility is common but the richness of the waterway's marine wildlife and the records, photographs and experience acquired by Seasearch divers in the Haven are rewarding and valuable, and make the effort worthwhile.

5. ACKNOWLEDGEMENTS AND CREDITS

Many thanks to all the 104 committed Seasearch divers who have taken part in these surveys and have been involved over the twelve year period covered by this report.

The diving would not be possible without our helpful local dive boat charters; thanks to Andy Truelove, Steve Lewis, Alun Lewis and Brian Dilly.

Thanks also go to Liz Morris who organised and ran two weekends of Seasearch diving, one for the 2010 eelgrass survey in Longoar Bay and the other to complete the 2011 native oyster surveys.

Guidance for survey locations has been provided by Aethne Cooke and Mike Camplin (CCW/NRW), Sue Burton (Pembrokeshire Marine SAC) and Blaise Bullimore (MHWESG).

Many fantastic photographs have been provided to produce this report and some great sketches completed, thanks to all those who have contributed:

Sketches: Richard West (RW), Vicky Swales (VS), Vicki Howe (VH), Blaise Bullimore (BB), Sarah Drake (SD), Kate Lock (KL), Jim Bull (JB) and Scott Tompsett (ST)

Photos: David Kipling (DK), Sarah Bowen (SB), Blaise Bullimore (BB), Louise Bebb (LB), Chris Wood (CW), Kate Lock (KL), Emily Williams (EW), Rob Spray (RS) and Francis Bunker (FB).

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APPENDIX 1

JNCC MNCR sublittoral biotopes identified

Infralittoral rock biotopes

- IR.MIR.KR.Ldig *Laminaria digitata* on moderately exposed sublittoral fringe rock. (Stack Rock).
- IR.MIR.KR.Lhyp.Tx *Laminaria hyperborea* on tide swept infralittoral mixed substrata. (Castle Rocks east shore, West Stack Rock).
- IR.MIR.KR,Lhyp.Fe *Laminaria hyperborea* forest and foliose red seaweed on moderately exposed upper infralittoral rock. (Stack Rock).
- IR.MIR.KR.Lhyp.T.Ft *Laminaria hyperborea* forest, foliose red seaweed and diverse fauna on tide-swept upper infralittoral rock. (Little Castle Head).
- IR.MIR.KR.Lhyp.Pk *Laminaria hyperborea* park and foliose red seaweeds on tide swept lower infralittoral mixed substrata. (Watch house point, West Blockhouse).
- IR.MIR.KFaR.FOR Foliose red seaweed on exposed lower infralittoral rock. (Stack Rock, Great Castle Head, Sandy Haven, Chester Point, Monk Haven Point, Rat Island reefs, Sheep Island).
- IR.MIR.KR.XOR Dense foliose red seaweed on moderately exposed silted, stable infralittoral rock. (Rat Island reefs).
- IR.HIR.KFaR.Lhyp *Laminaria hyperborea* and red foliose seaweed on moderately exposed infralittoral rock. (Millbay).

Circalittoral rock biotopes

- CR.FCR.FouFa Fouling faunal communities. (Rudders moorings, Beggars reach, Thor, Dakotian).
- CR.FCR.Fou.Fa.Aas *Ascidella aspersa* fouling community on circalittoral artificial substrata. (Newton Noyes Jetty and Mortello reef)
- CR.MCR.CFaVS Circalittoral variable salinity faunal communities (Rudders moorings, West Stack Rock).
- CR.MCR.CFa.VS.CuSpH.Ass Cushion sponges, hydroids and ascidians on tide swept, turbid, sheltered circalittoral rock. (Castle Rocks east shore, Warrior, Barnlake, Jenkins Point, North Cleddau bridge).
- CR.MCR.CFaVS.CuSpH.VS Cushion sponges and hydroids on tide swept, turbid variable salinity, sheltered circalittoral rock. (Castle Rocks west shore, Pennar

Gut, Rhooseferry, Barnlake, Jenkins Point, Llandstadwell dropoff).

CR.MCR.EcCrCarSp *Caryophyllia smithii*, sponges and curstose communities on wave exposed circalittoral rock. (Chester Point).

CR. HCR.XFa Mixed faunal turf communities. (Lindsay reef, Sandy Haven reefs, Watwick Point, West Blockhouse, Rat Island reefs).

CR.HCR.XFa.ByErSp Bryozoan turf, erect sponges on tide swept circalittoral rock. (Millbay, Monk Haven Point, Great Castle Head, Rat Island reefs).

CR.FCR.FouFa.Adig.Msen *Alcyonium digitatum* and *Metridium senile* on moderately wave exposed circalittoral steel wrecks. (Landing craft, Behar).

Sublittoral Sediment biotopes

SS.SMx.SMxVS Sublittoral mixed sediment in variable salinity. (Pwllcrochan flats, Algor Bouy).

SS.SMx.SMxVS.Cre.Med *Crepidula fornicata* and *Mediomastus fragalis* on variable salinity mixed sediment. (Beggars reach, Castle Rocks west shore, Jenkins Point, North Cleddau bridge, Pennar Gut, Stack Rock,).

SS.SMx.IMX.Cre.AS.An *Crepidula fornicata* with ascidians and anemones on infralittoral course mixed sediment. (Llangwm, Beggars reach, Castle Rocks west shore, Warrior, Barnlake, Pennar Gut).

SS.SMx.IMx.Ost *Ostrea edulis* beds on shallow sublittoral muddy mixed sediment. (Rudders moorings).

SS.SMuISaMu Infralittoral sandy mud. (Mortello reef, Thor).

SS.SSa.IFi.Sa Infralittoral fine sand. (Stack Rock, Longoar bay, Sheep Island).

SS.SSa.IFi.Sa.Imo.Sa Infralittoral mobile clean sand with sparse fauna. (Sandy Haven reefs, Millbay, West Blockhouse).

SS.SCS.ICS Infralittoral coarse sediment. (West Stack Rock, Chester Point, Millbay).

SS.SMP.SSgr.ZMar *Zostera marina* beds on lower shore or infralittoral clean or muddy sand. (Longoar bay).

SS.SCS.CCS Circalittoral coarse sediment. (Thor).

SS.SMx.CMx Circalittoral mixed sediment. (Dakotian east reef).

SS.SCS.SCS.VS Circalittoral coarse sediment in variable salinity. (Watwick bay).