Cyfoeth Naturiol Cymru
Natural Resources Wales

Skomer Marine Conservation Zone Kelp Habitats survey 2024

NRW Evidence Report 955

Author Names: K. Lock, M. Burton, A. Massey & J. Jones

About Natural Resources Wales

Natural Resources Wales' purpose is to pursue sustainable management of natural resources. This means looking after air, land, water, wildlife, plants and soil to improve Wales' well-being, and provide a better future for everyone.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence-based organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well-resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

This Evidence Report series serves as a record of work carried out or commissioned by Natural Resources Wales. It also helps us to share and promote use of our evidence by others and develop future collaborations. However, the views and recommendations presented in this report are not necessarily those of NRW and should, therefore, not be attributed to NRW.

Report series:	Marine Evidence Report
Report number:	955
Publication date:	March 2026
Title:	**Skomer Marine Conservation Zone, Kelp Habitat Survey 2024**
Author(s):	Lock, K., Burton, M., Massey, A., Jones, J.,
Quality assurance:	Tier 2
Peer reviewer:	Paul Brazier
Approved by:	Lucie Haines
Restrictions:	None

Distribution list (core)

NRW Library, Bangor	2
National Library of Wales	1
British Library	1
Welsh Government Library	1
Scottish Natural Heritage Library	1
Natural England Library (Electronic Only)	1

Distribution list (others)

Via NRW website

Recommended citation for this volume:

Lock, K, Burton M, Massey, A & Jones, J. (2026) Skomer Marine Conservation Zone, Kelp Habitat Survey 2024. NRW Evidence Report 955.

Contents

Crynodeb gweithredol

Cafodd dulliau ar gyfer arolygu cynefinoedd lludwymon eu profi gan dîm deifio'r PCM, tîm o ddeifwyr gwirfoddol a fideo gollwng i lawr. Casglodd yr arolygon ddata ar ddwysedd rhywogaethau o ludwymon a rhywogaethau cysylltiedig o algâu, pysgod sy'n gysylltiedig â chynefinoedd lludwymon, cymunedau echinodermau a chramenogion, a chofnodion gweledol o gyflwr cynefinoedd lludwymon.

Cwblhawyd yr arolwg mewn pedwar safle, ac roedd y rhain wedi'u cyfyngu i gysgod arfordiroedd gogleddol Penrhyn Marloes ac Ynys Sgomer gan fod amodau'r môr yn rhy heriol ar arfordiroedd mwy agored y de a'r gorllewin yn ystod y cyfnod arolygu.

Darperir disgrifiad o'r safle a chanlyniadau'r arolwg. Bydd y rhain yn llinell sylfaen i gymharu ag arolygon yn y dyfodol.

Executive summary

Methods for surveying kelp habitats were tested by the MCZ dive team, a team of volunteer divers and drop-down video. The surveys collected data on kelp species density and associated algae species, kelp habitat associated fish, echinoderm and crustacean communities and visual records of kelp habitat condition.

Survey was completed at four sites, these were limited to the shelter of the north coasts of Marloes Peninsula and Skomer island as the sea conditions were too challenging on the more exposed south and west coasts during the survey period.

A site description and survey results are provided, these will form a baseline for comparison with future surveys.

.

1 Introduction

1.1 Importance of kelp habitats in the UK

Kelps are habitat forming species often termed ‘ecosystem engineers’ as they exert control over entire communities by modifying the environment and resources available to other organisms (Jones *et al* 1994). The presence of kelp alters light, nutrients, sediments, physical scour and water flow conditions for proximal organisms while providing structural habitat for a wide range of flora and fauna (Burrows *et al* 2014).

In the UK alone, over 1800 species have been recorded from kelp dominated habitats. Kelp habitats also provide habitat for large invertebrates such as echinoderms and crustaceans. The common urchin *Echinus esculentus* have significant ecological importance and the European lobster *Homarus gammarus* are of socio-economic importance. Kelp habitats are particularly effective nurseries for juvenile fish, providing shelter from predation and key feeding grounds for many fish species such as ballan wrasse *Labrus bergylta* and goldsinny wrasse *Ctenolabrus rupestris,* which prey on kelp associated invertebrates. In turn, elevated fish densities in kelp habitats attract large piscivores such as large fish and seals. Species richness on sublittoral rocky reefs around the UK generally increases with increasing relative abundances of all the major canopy forming kelp species (Burrows *et al* 2014).

1.2 Algae communities in Skomer MCZ

The Skomer MCZ has a wide range of habitats, including excellent examples of algal communities on bedrock, boulders and cobbles. Skomer MCZ’s algal communities have been identified as being rich and diverse with 241 species of red, green and brown algae recorded. This represents 34% of the British marine flora and 21% of North Atlantic marine flora including: two nationally scarce species; five near their limit of distribution; four species with specialised habitat preferences and five deep water algal species. Rare or threatened species include: *Atractophora hypnoides, Sphacelaria mirabilis, Hydrolithon cruciatum* and *Hincksia ovata* (Burton *et al* 2008). Skomer MCZ has been identified as a Criteria B European IPA (important plant area) for marine algae.

Kelp habitats dominate the infralittoral zone on bedrock and boulder reefs found along most of the Skomer MCZ coast. Kelp species recorded in Skomer MCZ include oar weed *Laminaria digitata*, forest kelp *Laminaria hyperborea*, dabberlocks *Alaria esculenta*, furbelows *Saccorhiza polyschides* and sugar kelp *Saccharina latissima*. The relative abundance of kelp species is influenced by a range of abiotic (e.g. temperature, latitude, wave exposure, light levels, disturbance) and biotic (e.g. competition, grazing) factors.

The first algae survey in Skomer MCZ was in 1983 when a detailed survey was completed of macro-algal populations at a number of sites (Hiscock 1983). This was followed in 1984 when a monitoring project of sub-littoral seaweeds at two sites on the north coast of Skomer Island was established for a 2-year project (Hiscock 1986).

In 1998, Brodie and Watson were contracted by Countryside Council for Wales to provide advice on development of conservation objectives for algal species and community monitoring. In 1999 a survey was carried out at seven sites based on their recommendations and a Skomer MCZ algae herbarium was produced (Brodie & Bunker,

2000). In 2007, Maggs, Johnson and Bunker were contracted to develop methods of quantitative algae species monitoring building on the previous studies and recommendations. A survey was completed where species lists were derived from timed searches at selected depths and kelp density counts were completed at selected sites (Burton *et al* 2008).

In 2024 methods for surveying kelp habitats were reviewed and diving methods were selected for testing by both the Skomer MCZ dive team and volunteer dive teams. The methods were tested at a selection of sites and the results detailed in this report.

2. Objectives

The 2024 survey aimed to develop methods for the following objectives:

- To monitor kelp species density and associated algae species at sites representing a range of wave and tidal current exposures.
- To monitor kelp habitat associated fish, echinoderm and crustacean communities.
- To collect visual records of kelp habitat condition.

3. Methods

The survey is completed in two zones, the kelp forest zone and kelp park zone which are defined by the density cover of kelp plant holdfast in a defined area (Burrows *et al* 2014).

- Kelp park zone, lower infralittoral, kelp plants < 5 % holdfast cover in a defined area
- Kelp forest zone, upper infralittoral, kelp plants > 20% holdfast cover in a defined area

In the Skomer MCZ the kelp park is found deeper than the kelp forest, the depths of these zones varies at each site.

3.1 Kelp habitat density and algae species recording

The method requires good algae identification skills.

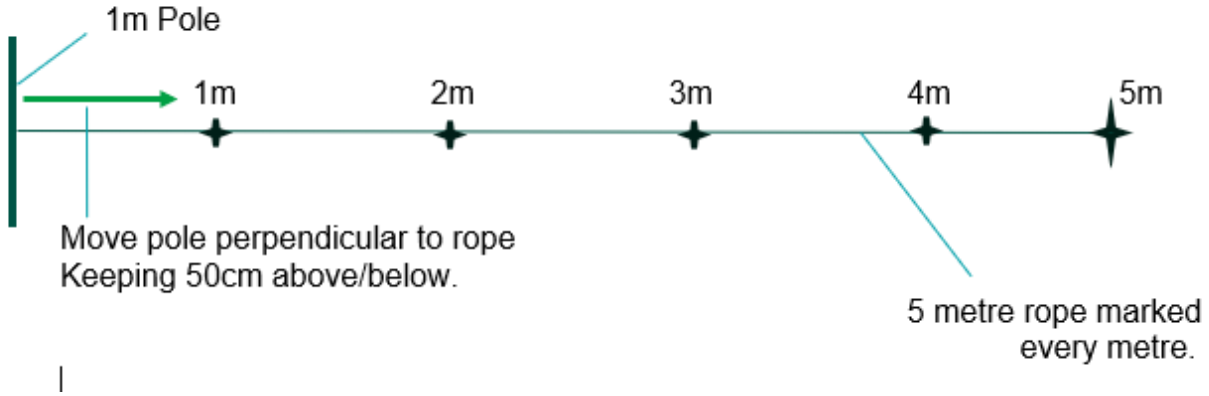
Equipment: 2 x 5m weighted ropes marked every metre with fluorescent cable ties and string secured to ends and centre, 2 x 1 metre white poles marked with black tape at centre, 2 x writing slates/proforma.

The writing slate/proforma is pre-prepared for recording as shown in Appendix 1.

Method:

1. Record depth of the deepest kelp plant found.
2. Select area in kelp park to complete survey.
3. Dive pair lay 2 weighted 5m ropes end to end along depth contour in the kelp park zone, securing using string attached to ends and centre (tie to kelp plants).
4. Each diver completes the survey on one 5m rope section simultaneously, (i.e. Diver 1 completes quadrats 1-5 whilst Diver 2 completes quadrats 6-10).
5. Use a 1m pole marked at centre – place pole perpendicular to the rope with centre of pole next to the rope (pole is 50cm above and below the rope), see Figure 3.1.

Figure 3.1 Rope layout and pole method



6. Move pole along rope recording within each 1m^2 area:
    a) Number of adult kelp plants (>50cm length) for each kelp species.
    b) Number of juvenile kelp plants (<50cm length) not to species level.
    c) Number of benthic fish, crustaceans, echinoderms to species level.
    d) Percentage cover of foliose algae (grouped for all species) and the percentage cover of encrusting algae.
    e) Record names of dominant red and brown algae present on rock. This is eased by having a list of common species with 2/3 letter codes taped to the back of the recording slate that could be used by the recorder, see Table 3.1.

Table 3.1 Example list of common algae species with abbreviation codes

Code	Species
Ba	*Bonnemaisonia asparagoides*
Cc	*Calliblepharis ciliata*
Cl	*Callophyllis laciniata*
Cr	*Cryptopleura ramosa*
Ds	*Delesseria sanguinea*
Dc	*Dilsea carnosa*
Hp	*Heterosiphonia plumosa*
Kr	*Kallymenia reniformis*
Pp	*Palmaria palmata*
Pl	*Plocamium sp*
Vb	*Vertebrata byssoides*
ENC	*Encrusting coralline*
Dd	*Dictyota dichotoma*
Dp	*Dictyopteris polypodioides*
He	*Himanthalia elongata*
Dl	*Desmarestia ligulata*
Da	*Desmarestia aculeata*
Car	*Carpomitra costata*

7. Recover the equipment and move to a suitable location in the kelp forest zone and repeat method 2 to 6 above.

3.2 Fish, echinoderms, crustaceans in kelp habitats

The method has been designed for use with volunteer divers and follows the methods used for territorial fish population survey (Lock *et al* 2006a) and for the echinoderm population survey (Lock *et al* 2020).

Equipment: 1x 30m tape, 1 small weight (shackle with string loop), 1 writing slate/proforma, urchin measuring dividers, fish identification sheet (see Appendix 3).

The writing slate/proforma is pre-prepared for recording as shown in Appendix 2:

Method:

1. Record the maximum depth at which a kelp plant is found and record all the kelp species present.

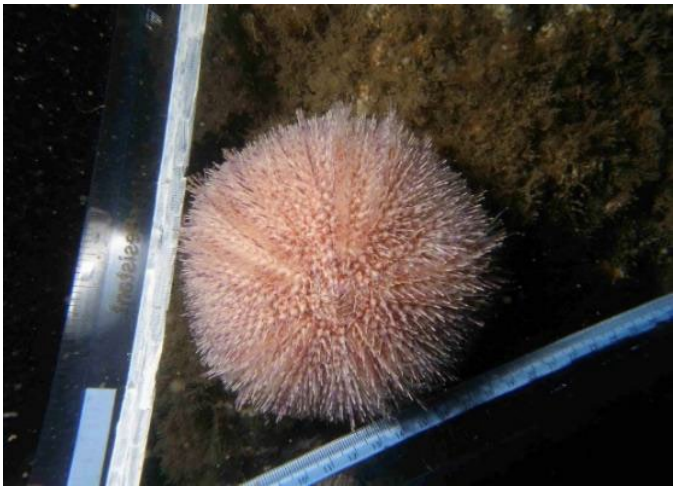
2. Dive pair attach weight to a 30m tape and secure to the reef in the kelp park zone, record the depth and time.

3. One diver start laying the tape along the depth contour, the first 5m are used to obtain control in orientation and buoyancy.

4. From the 5m mark the dive buddy (with writing slate/proforma) begin fish counts for each species within a 2m corridor, 1m either side of the tape, divers go very slowly so as not to disturb the fish and maintain a swimming speed of 3m per minute. If needed use laminated fish identification sheets to assist species identification. see Appendix 3.

5. On completion of the 25m transect, one diver rewind the tape slowly and in a 2m corridor, 1m either side of the tape, the dive buddy count numbers of crustacean species (edible crab, velvet swimming crab, spider crab and lobster), starfish species (common and spiny starfish) and count and measure common urchin found, using the urchin dividers, see Figure 3.2. (Urchin measuring method detailed in Lock *et al* 2020)

Figure 3.2 Measuring common urchin with urchin divider



6. Repeat steps 2 to 5 in the kelp forest zone.

7. On return to the boat the data is transferred onto the kelp communities recording form, see Appendix 4.

3.3 Kelp habitat condition records

A Remote Underwater Video System (RUVS) is used to record the condition of the kelp and algae habitat, the presence of mobile species and to obtain a condition record of the algae community at a selection of sites.

Equipment: the RUVS system (Figure 3.3) comprises a GoPro11 in an underwater housing, 64GB memory card, modified lobster pot frame with GoPro camera mount; a

length of rope and a marker buoy, ‘clapper board’ (wipeable slate with site / date / deployment time / and any other relevant information written on it).

Figure 3.3 Skomer MCZ's Remote Underwater Video System (RUVS).

Method:

1. Adjust the length of rope to allow for current state of tide (ensuring enough slack for any expected tidal increase during deployment).

2. Select location (pre-determined waypoint or use of echosounder to select suitable site).

3. Start the video and show clapper board to camera (wipeable slate with site / date / deployment time / baited / un-baited and any other relevant information).

4. Gently lower the frame, controlling the descent to keep the frame upright and reduce the possibility of the camera angle being knocked.

5. When retrieving the pot try to align the boat to allow a straight vertical pull (reducing the risk of snagging / camera damage).

6. Stop the video (if still recording).

4. Survey method testing results

The methods were tested by the MCZ dive team, a team of volunteer divers and drop-down video. Sea conditions with swell and wave surge made the completion of the survey at many of the planned sites not possible. Most sites are located on the open coast and some at exposed locations, meaning flat calm seas are essential to complete the survey.

4.1 Kelp habitat density and algae species recording

The Skomer MCZ team completed the method at several sites. To complete the transects in both the kelp park and kelp forest zone took an average of 60 minutes.

The weighted rope was divided into 2 x 5m lengths so a pair of divers could work along one length each. Ties were added to the ends and middle of the rope to allow it to be secured to kelp holdfasts and stay fixed against the steep sloping rock preventing it from sliding down. The 5m ropes were set up end to end along a depth contour. The divers worked simultaneously along a 5m rope section each to complete 5 x 1m^2 quadrat areas. The use of the 1m pole positioned with the centre perpendicular to the rope and then moving between the fluorescent cable tie markers on the rope worked well. The pole was moved along the rope and could be repositioned around kelp plants. This allowed flexibility in working in dense kelp areas which would not have been possible with a large four-sided quadrat.

Figure 4.1 Diver recording kelp density data (credit Blaise Bullimore)

A good level of algae identification skill is needed to allow recording of the conspicuous red and brown algae species present. This was eased by creating a list of species with 2 letter codes taped to the back of the recording slate that could be used by the recorder. To allow the large amount of data to be collected a well organised recording sheet taped to the slate was essential. This also allowed the surveyor to check that everything needed was recorded.

4.2 Fish, echinoderms, crustaceans in kelp habitats

A volunteer dive team over one weekend were tasked with completing transects in the kelp park and kelp forest zones to record fish, echinoderm (common urchin were also measured) and crustacean species. In addition, they also recorded the kelp species found and the maximum depth of kelp found at the site.

The method was a merge of the methods developed for territorial fish recording and urchin and starfish recording (fully described in Lock, 2006 & 2007). Both these surveys had been previously completed by volunteer teams and are based on using a 30m or 50m tape being secured and laid out along a depth contour. The volunteers found combining the recording of the 2 surveys straightforward and it was not difficult to add recording number of crustacean species to the method.

Figure 4.2 Diver preparing to lay transect tape in High Point kelp forest zone (credit Blaise Bullimore)

The volunteers found the method manageable. They found that dividing the tasks between the buddy pair was important; one took responsibility for completing the species counts whilst the other took charge of the tape and measuring urchins. It was also essential to have pre-prepared writing slates to help ensure that all recording was completed.

Figure 4.3 Volunteer diver with writing slate measuring common urchin along transect line (credit Blaise Bullimore).

A good level of species identification skill was required, so some pre-training is needed. Fish identification is aided by the provision of fish ID sheets and a pre-dive briefing.

Sea conditions were the trickiest challenge. Even with only 1m height swell, it was difficult to complete the transects as this causes water movement back and forth in the shallow waters where kelp is found. For divers to hold position and follow a depth contour, minimal water movement is essential.

4.3 Kelp habitat condition records

A Remote Underwater Video System (RUVS) was deployed at 3 sites for 1-2 hours at a time. The aim was to obtain a visual condition record of the algae habitat and record the presence of mobile species.

The method proved challenging due to the steep, uneven rocky seabed in the inshore areas of the Skomer MCZ where algae communities are found. The modified lobster pot housing the camera was lowered slowly to try and keep it upright on landing on the seabed, but the video records showed that the system was usually positioned at different angles and

snagged in the kelp plants. The video records did successfully provide a visual record of algae habitats (Figure 4.4) but only rarely recorded the presence of mobile species.

Figure 4.4 A selection of algae community images captured by the RUVS

The modified lobster pot housing the camera proved effective in protecting the camera from getting snagged on the uneven seabed or by kelp plants.

The RUVS was a good method in gaining a visual condition of the algae communities at a selection of sites that can be stored as a permanent record. A benefit of the method is that deployments can be combined with routine monitoring activities thus requiring minimal additional time and effort.

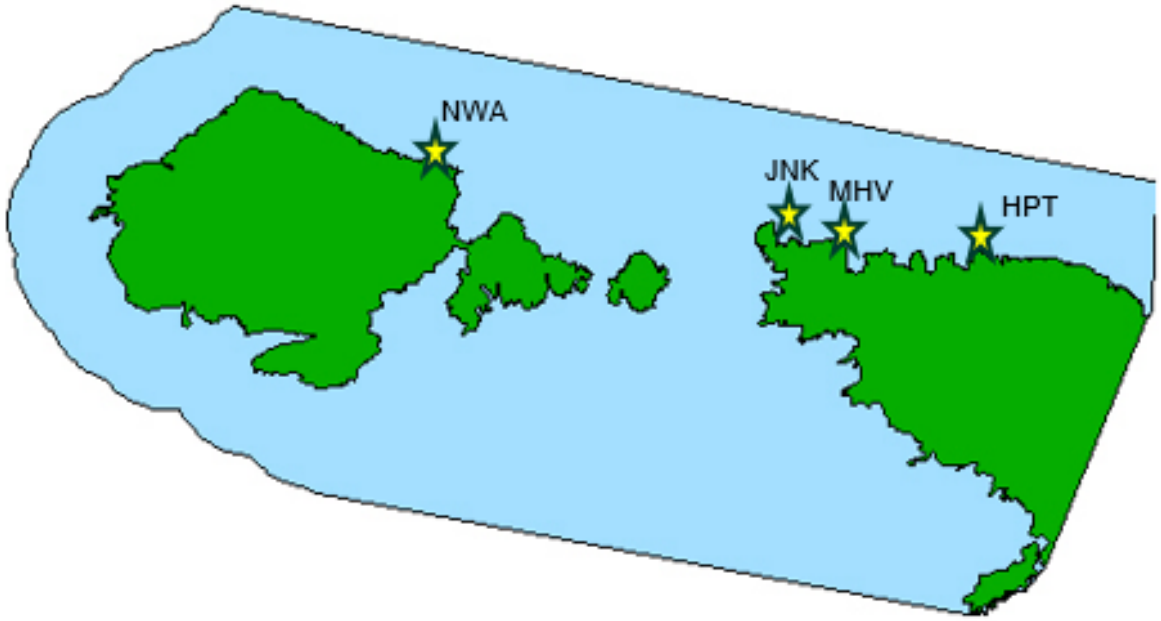
The method however has limitations. It only provides a visual record at the location that it lands on the seabed and it is not possible to target the kelp forest and kelp zones. It was also not particularly effective in recording presence of mobile animal species.

These limitations could be overcome if in additional video records can be done by divers completing a 30m ‘swim through’ the kelp park and kelp forest zones at each site with a video camera. This would however need an additional dive at each site.

5. Survey site results

Kelp habitat density and associated kelp communities was recorded at 4 sites: Junkos reef (JNK), Martins Haven west (MHV), High point (HPT) and North wall (NWA). The site locations are shown in Figure 5.1.

Figure 5.1 Survey site location map.



The sites were limited to the shelter of the north coasts of Marloes Peninsula and Skomer island as the sea conditions were too challenging on the more exposed south and west coasts during the survey period.

Two kelp species were recorded at each site, *Laminaria hyperborea* and *Sacchorhiza polyschides.* The distribution of these for the kelp forest zone are shown in Figure 5.2 and for the kelp park zone in Figure 5.3. At Martins Haven west and High Point *Laminaria hyperborea* was the dominant species whereas at Junko's reef and North Wall *Sacchorhiza polyschides* was the more abundant species present. *Saccharina latissimi* was recorded but only in very low numbers at Junko's reef.

Figure 5.2 Percentage distribution *Laminaria hyperborea* and *Sacchorhiza polyschides* in the kelp forest zone at each survey site. (Junko reef JUNKO, Martins Haven west MHVw, High Point HPT, North Wall NWA)

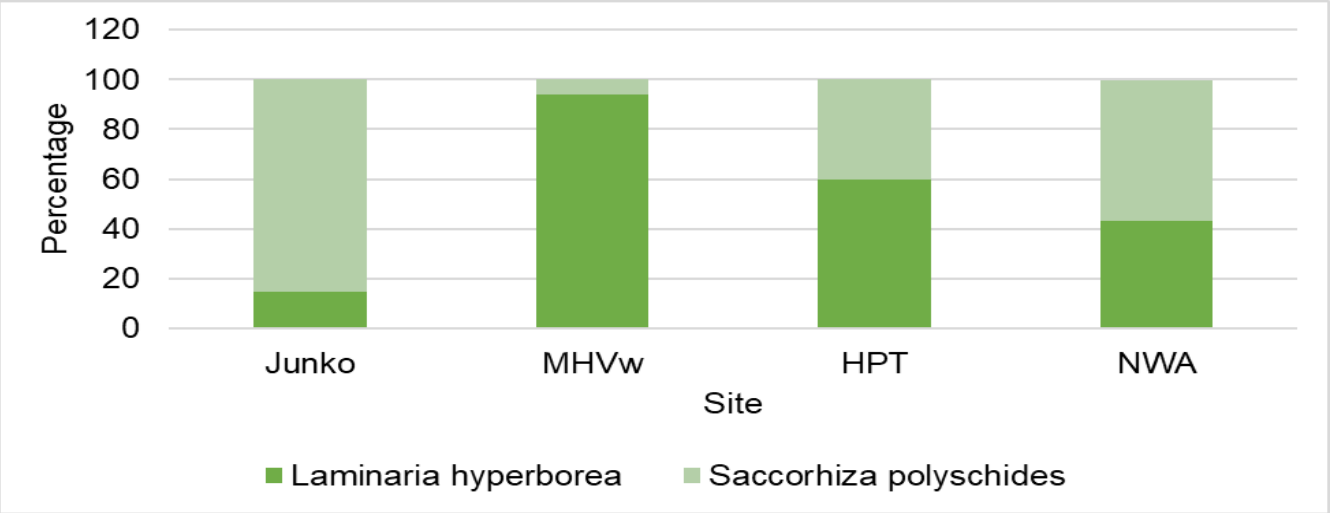
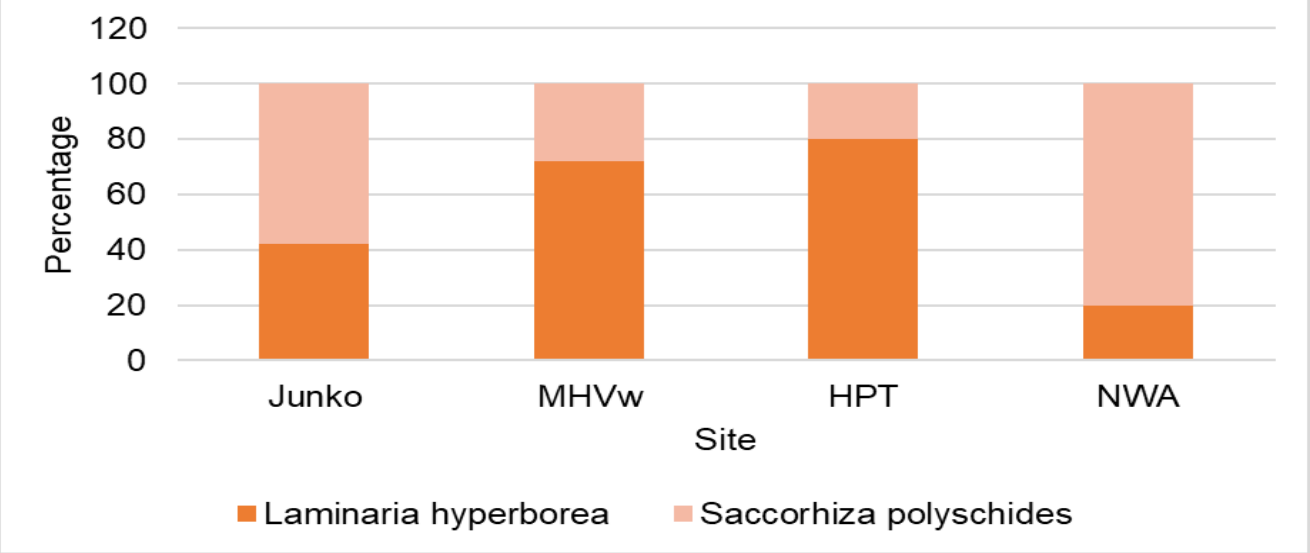


Figure 5.3 Percentage distribution *Laminaria hyperborea* and *Sacchorhiza polyschides* in the kelp park zone at each survey site. (Junko reef JUNKO, Martins Haven west MHVw, High Point HPT, North Wall NWA)



A site description and survey results are provided in Section 5.1 to 5.4. The results will form a baseline for comparison with future surveys.

The fish and echinoderm density data has been added to additional surveys completed of these groups at deeper depths during 2025. The data has been analysed and compared with previous surveys and results published in Lock *et al* 2026c.

In addition to recording conspicuous algae species as part of the kelp density transects the survey also benefited from general algae species recording by algae identification specialist Francis Bunker at Martins Haven west, High Point and North Wall, these are listed in Appendix 5.

5.1 Junko's Reef, Wooltack Bay

A rocky reef semi-exposed to wave action from the north and moderate tidal currents. The reef juts out from the coast within Wooltack bay, the top of the reef is a flat plateau around 30m across at 5-6m below chart datum (bcd). Steep vertical faces are found on the north-west, north and north-east sides down to 20m bcd, and shallower boulder slopes on the south-west, south and south-east sides of the reef. The deepest kelp plant was recorded at 10.5m bcd.

Figure 5.4. Sketch of kelp forest and kelp park zones at Junko's reef

Kelp forest

The kelp forest was dominated with *Saccorhiza polyschides* along with small patches of *Laminaria hyperborea* and healthy numbers of juvenile kelp plants. *Saccharina latissima* was occasionally recorded. Kelp plant density was recorded in an area 10m^2 at depth 5.5m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	4.6/m^2
Laminaria hyperborea	0.8/m^2
Juvenile kelp	3.4/m^2

Foliose red and brown algae cover ranged between 10 to 50 % cover with an average of 23.5%. Conspicuous species present*: Delesseria sanguinea, Cryptopleura ramosa, Bonnemaisonia asparagoides, Heterosiphonia plumosa, Kallymenia reniformis, Palmaria palmata, Vertebrata byssoides, Plocamium sp,* encrusting coralline algae.

Kelp park

The kelp park occupies a narrow band where the kelp forest thins out with depth. *Saccorhiza polyschides* and *Laminaria hyperborea* were both recorded along with juvenile kelp plants. Kelp plant density was recorded in an area 10m^2 at 7.5m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	1.1/m^2
Laminaria hyperborea	0.8/m^2
Juvenile kelp	1.7/m^2

Foliose red and brown algae cover ranged between 40 to 60 % cover with an average of 48%. Conspicuous species present*: Delesseria sanguinea, Cryptopleura ramosa, Bonnemaisonia asparagoides, Heterosiphonia plumosa, Kallymenia reniformis, Palmaria palmata, Vertebrata byssoides, Plocamium sp,* encrusting coralline algae.

Mobile animal species were recorded along transects in a total area 150m^2 in the kelp forest zone and 200m^2 in the kelp park zone, results are shown in Table 5.1.

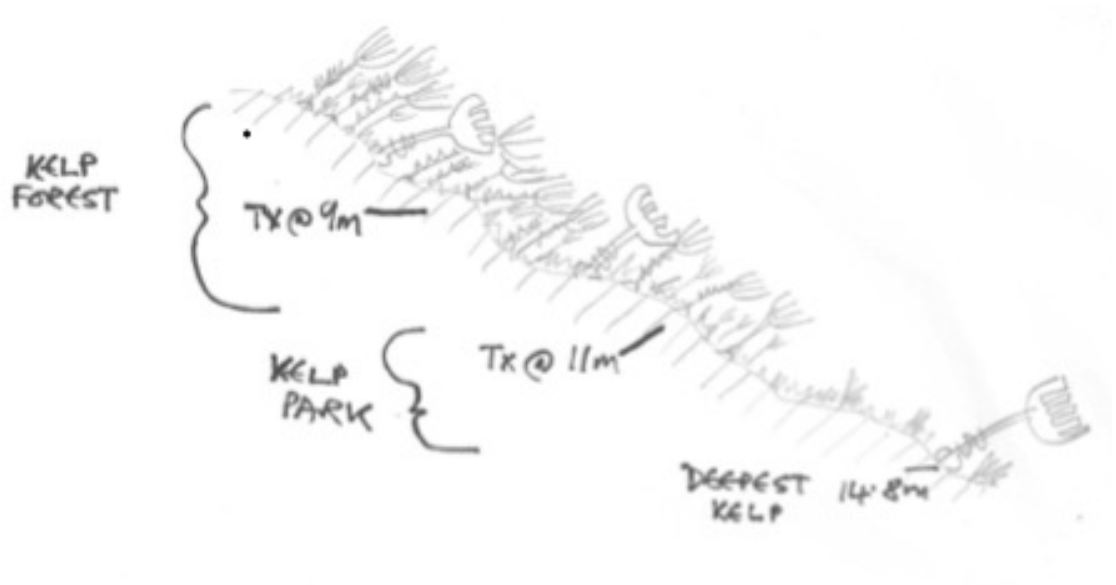
Table 5.1 Density of animal species recorded in the Junko's reef kelp forest and kelp park zones.

Species	Kelp forest zone: Number/100m^2	Kelp park zone: Number/100m^2
Labrus bergylta	2.6	3
Ctenolabrus rupestris	0	2.5
Crenilabrus melops	0.6	1
Ctenolabrus exoletus	0.6	0.6
Labrus mixtus	1.5	0
Necora puber	0	1
Maja squinado	4	4.5
Echinus esculentus	9.3	12

5.2 Martins Haven west

A bedrock reef interspersed with boulders located due west of Martins Haven bay, semi-exposed to wave action from the north and moderate tidal currents. The deepest kelp plant was recorded at 14.8m bcd.

Figure 5.5. Sketch of kelp forest and kelp park zones at Martins Haven west



Kelp forest
The kelp forest was dominated with *Laminaria hyperborea* with occasional *Saccorhiza polyschides* and high number of juvenile kelp plants. Kelp plant density was recorded in an area 10m^2 at depth 9.4m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	0.3/m^2
Laminaria hyperborea	4.6/m^2
Juvenile kelp	6.3/m^2

Foliose red and brown algae cover ranged between 20 to 80% cover with an average of 61.5%. Encrusting algae cover ranged between 0 to 35% cover with an average of 16%.

Conspicuous species present*: Bonnemaisonia asparagoides, Dictyota dichotoma, Dictyopteris polypodioides, Delesseria sanguinea, Calliblepharis ciliata, Kallymenia reniformis, Palmaria palmata, Dilsea carnosa, Heterosiphonia plumosa, Cryptopleura ramosa, Drachiella spectabilis,* encrusting coralline algae.

Kelp Park
The kelp park zone was limited to the narrow band where the kelp forest thins out with depth. *Laminaria hyperborea* was the most common kelp species with occasional *Saccorhiza polyschides* and healthy numbers of juvenile kelp plants. Kelp plant density was recorded in an area 10m^2 at depth 11.3m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	1.0/m^2
Laminaria hyperborea	2.6/m^2
Juvenile kelp	2.0/m^2

Foliose red and brown algae cover ranged between 35-100% cover with an average of 77.5%. Encrusting algae cover ranged between 0 to 30% cover with an average of 9.5%.

Conspicuous species present*: Calliblepharis ciliata, Delesseria sanguinea, Bonnemaisonia asparagoides, Kallymenia reniformis, Heterosiphonia plumosa, Dictyota dichotoma, Dictyopteris polypodioides, Callophyllis laciniata,* encrusting coralline algae.

Mobile animal species were recorded along transects in a total area 100m^2 in the kelp forest zone and 100m^2 in the kelp park zone, results are shown in Table 5.2.

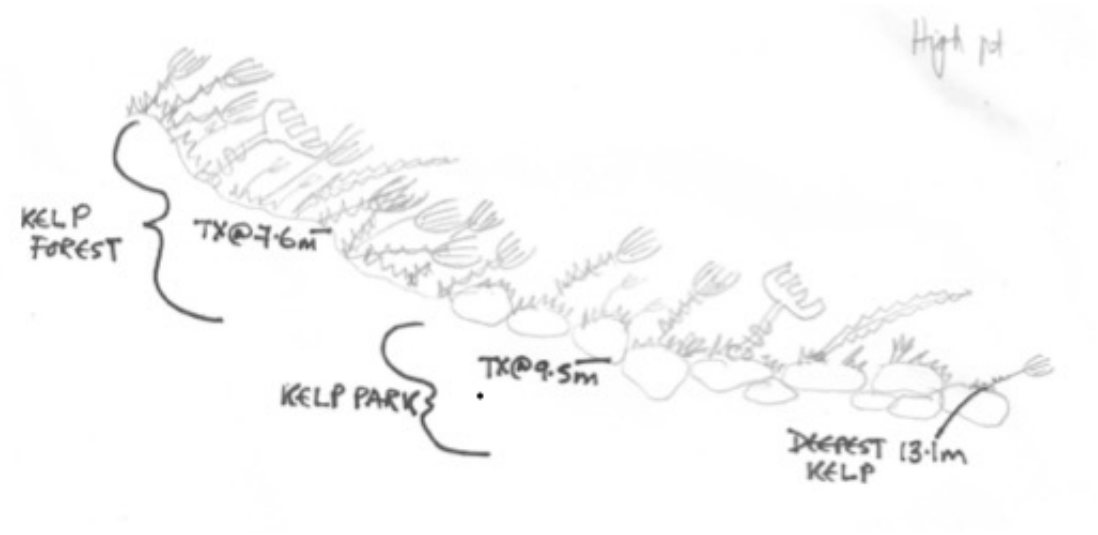
Table 5.2 Density of animal species recorded in the Martins Haven west kelp forest and kelp park zones.

Species	Kelp forest zone: Number/100m^2	Kelp park zone: Number/100m^2
Labrus bergylta	4	3
Crenilabrus melops	1	1
Ctenolabrus exoletus	1	1
Thorogobius ephippiatus	2	1
Taurulus bubalis	0	1
Cancer pagarus	1	0
Necora puber	4	0
Maja squinado	2	1
Echinus esculentus	5	3

5.3 High Point

A bedrock reef sloping around 45 degrees leading down to extensive gentle sloped boulder area. The site is semi-exposed to wave action from the north and moderate tidal currents. The deepest kelp plant was recorded at 13.1m bcd.

Figure 5.6 Sketch of kelp forest and kelp park zones at High Point.



Kelp forest

The kelp forest was on the bedrock reef down to 8m bcd. The forest was composed of both *Laminaria hyperborea* and *Saccorhiza polyschides* along with juvenile kelp plants. *Saccharina latissima* was occasionally recorded. Kelp plant density was recorded in an area 10m^2 at depth 7.6m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	2.6/m^2
Laminaria hyperborea	3.8/m^2
Juvenile kelp	3.7/m^2

Foliose red and brown algae cover ranged between 40 to 80% cover with an average of 67.5%. Encrusting algae cover ranged between 5 to 25% cover per m^2 with an average of 12%.

Conspicuous species present*: Calliblepharis ciliata, Dilsea carnosa, Heterosiphonia plumosa, Delesseria sanguinea, Callophyllis laciniata, Dictyopteris polypodioides, Dictyota dichotoma, Kallymenia reniformis, Cryptopleura ramosa, Desmarestia ligulata, Bonnemaisonia asparagoides,* encrusting coralline algae.

Kelp park

The kelp park was found on the gentle boulder slope. The park was mainly *Laminaria hyperborea* with occasional *Saccorhiza polyschides* and healthy numbers of juvenile kelp plants. *Saccharina latissima* was occasionally recorded.

Figure 5.7 Diver recording algae species in High Point kelp park zone (credit Blaise Bullimore)

Kelp plant density was recorded in an area $10m^2$ at depth 9.5m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	$0.3/m^2$
Laminaria hyperborea	$1.2/m^2$
Juvenile kelp	$2.1/m^2$

Foliose red and brown algae cover ranged between 35 to 100% cover per m^2 with an average of 77.5%. Encrusting algae cover ranged between 0 to 50% cover with an average of 5%.

Conspicuous species present*: Delesseria sanguinea, Dilsea carnosa, Calliblepharis ciliata, Heterosiphonia plumosa, Dictyopteris polypodioides, Callophyllis laciniata, Kallymenia reniformis, Dictyota dichotoma, Bonnemaisonia asparagoides, Carpomitra costata,* encrusting coralline algae.

Mobile animal species were recorded along transects in a total area $100m^2$ in the kelp forest and kelp park zones results are shown in Table 5.3.

Figure 5.3 Density of animal species recorded in the High Point kelp forest and kelp park zones.

Species	Kelp forest zone: Number/100m^2	Kelp park zone: Number/100m^2
Labrus bergylta	6	8
Ctenolabrus rupestris	0	2.5
Crenilabrus melops	2	0
Ctenolabrus exoletus	5	4
Thorogobius ephippiatus	0	3
Parablennius gattorugine	0	1
Taurulus bubalis	0	1
Cancer pagarus	0	2
Necora puber	1	4
Maja squinado	3	8
Echinus esculentus	8	3

5.4 North Wall

A bedrock reef and boulders semi-exposed to wave action from the north and moderate tidal currents. There are steep vertical faces broken up by rock ridges, ledges and boulder slopes. The deepest kelp plant was recorded at 9.5m bcd.

Figure 5.8 Sketch of kelp forest and kelp park zones at North Wall.

Kelp forest
The kelp forest was on the bedrock reef down to 8m bcd. The forest was composed of both *Saccorhiza polyschides* and *Laminaria hyperborea* along with high numbers of juvenile kelp plants.

Figure 5.9 Diver recording in the North Wall kelp forest zone (credit Blaise Bullimore)

Kelp plant density was recorded in an area 10m^2 at depth 7.2m bcd.

Average counts of adult and juvenile kelp plants:

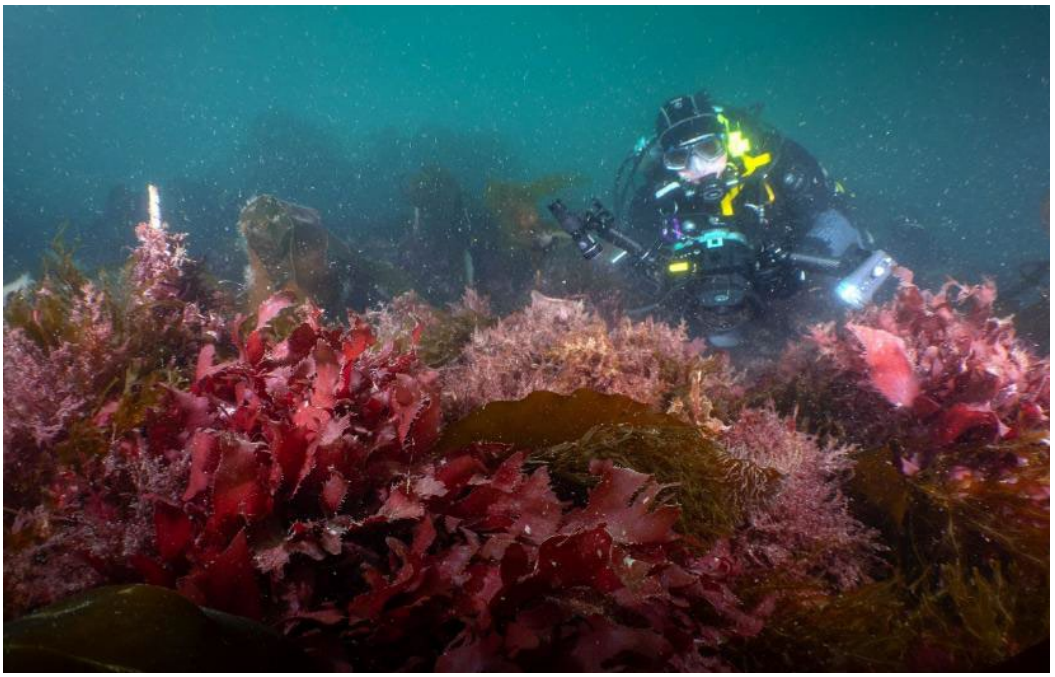
Saccorhiza polyschides	3.4/m^2
Laminaria hyperborea	2.6/m^2
Juvenile kelp	9.4/m^2

Foliose red and brown algae cover ranged between 30 to 95% cover with an average of 54.5%. Encrusting algae cover ranged between 0 to 20% cover with an average of 7.0%. Conspicuous species present*: Delesseria sanguinea, Bonnemaisonia asparagoides, Callophyllis laciniata, Calliblepharis ciliata, Plocamium sp., Dictyopteris polypodioides, Dictyota dichotoma, Kallymenia reniformis, Heterosiphonia plumosa, Dilsea carnosa, Cryptopleura ramosa, Vertebrata byssoides,* encrusting coralline algae.

Kelp park

The kelp park zone was limited to the narrow band where the kelp forest thins out with depth, *Saccorhiza polyschides* was the most common kelp species with occasional *Laminaria hyperborea* and healthy numbers of juvenile kelp plants.

Figure 5.10 Diver recording in the North Wall kelp park zone (credit Blaise Bullimore)



Kelp plant density was recorded in an area 10m^2 at depth 8.2m bcd.

Average counts of adult and juvenile kelp plants:

Saccorhiza polyschides	1.9/m^2
Laminaria hyperborea	0.5/m^2
Juvenile kelp	1.7/m^2

Foliose red and brown algae cover ranged between 10 to 95% cover with an average of 62.5%. Encrusting algae cover ranged between 5 to 25% cover with an average of 7.0%

Conspicuous species present*: Delesseria sanguinea, Dilsea carnosa, Calliblepharis ciliata, Heterosiphonia plumosa, Dictyopteris polypodioides, Callophyllis laciniata, Kallymenia reniformis, Dictyota dichotoma, Bonnemaisonia asparagoides, Vertebrata byssoides,* encrusting coralline algae.

Mobile animal species were recorded along transects in a total area 50m^2 in the kelp forest and kelp park zones, results are shown in Table 5.4.

Figure 5.4 Density of animal species recorded in the North Wall kelp forest and kelp park zones.

Species	Kelp forest zone: Number/100m^2	Kelp park zone: Number/100m^2
Labrus bergylta	6	2
Ctenolabrus exoletus	0	2
Necora puber	1	0
Maja squinado	3	0
Marthasterias glacialis	2	2
Echinus esculentus	8	8

6. Recommendations

- To use the 2024 data as a baseline of kelp habitats at selected sites and repeat every 4 years.
- To continue recording kelp densities and algae species in kelp habitats.
- To use volunteer dive teams to record densities of fish, echinoderm and crustacean communities in kelp habitats.
- To use RUVS and diver video swim throughs to provide visual records of kelp habitat.
- To expand the 2024 survey to further sites with a range of wave and current exposures, including sites located on the south and west sides of Skomer island.

7. Acknowledgements

The Skomer MCZ staff would like to thank our local volunteers that helped make up the work diving team for this survey: Phil Newman, Becky Tooby, Blaise Bullimore, Jon Moore and Francis Bunker. Thanks also to Francis for providing his specialist algae identification skills to record algae species and Blaise for providing some fantastic pictures of the team working.

Figure 7.1 Skomer MCZ and local volunteers (credit Becky Tooby)

A big thankyou to the recreational volunteer divers that helped on the weekend survey and coping with the difficult sea conditions: Scott Tompsett, Ross Bullimore, Anthony Williams, Jo Prosser, Louise Bebb, Emma Lowe, Erin Smyth, Cleopatra Browne and Neo Channing.

Many thanks to Pembrokeshire Boat Charter and skipper David Stowell.

8. References

Brodie, J. & Watson, D. (1999) Skomer MNR community and species monitoring: algal communities. Advice on conservation objectives. CCW report no. 334.

Brodie, J & Bunker, F. (2000) Skomer MNR community and species monitoring: algal communities. CCW report 387.

Burrows, M.T., Smale, D., O'Connor, N., Van Rein, H. & Moore, P. (2014) Marine Strategy Framework Directive Indicators for UK Kelp Habitats Part 1: Developing proposals for potential indicators. JNCC Report No. 525

Burton, M., Lock, K., Gibbs, R. & Newman, P. (2008) Skomer Marine Nature Reserve Project Status Report 2007/08. CCW Regional Report CCW/WW/08/3

Hiscock, S. (1983) Skomer Marine Reserve seaweed Survey 1982. FSC/Pembrokeshire BSAC/UCS Skomer Marine Reserve 1982 Expedition Volume 1 FSC Report No. FSC/(OFC)/2/83

Hiscock, S. (1986) Skomer Marine Reserve Subtidal Monitoring Project. Algal Results August 1984 to February 1986. SMRSMP report No. 4. A report to the Nature Conservancy Council.

Jones, C.G., Lawton, J.H. & Shachak, M. (1994) Organisms as ecosystem engineers. Oikos, 69: 373-386.

Lock, K., Burton, M., Newman, P. & Jones, J. (2020) Skomer Marine Conservation Zone Distribution and Abundance of *Echinus esculentus* and selected starfish species 2019. NRW Evidence Report No.400.

Lock, K., Burton M., Newman, P. & Luddington, L. (2006a) Skomer Marine Nature Reserve Territorial Fish Population Study. CCW Regional Report CCW/WW/05/8.

Lock, K, Burton M, Massey, A & Jones, J. (2026c) Skomer Marine Conservation Zone, Project Status Report 2025. NRW Evidence Report 957.

Luddington, L. & Bunker, F. (2007) Algal monitoring in Skomer MNR and other sites around Wales. CCW Marine Monitoring Report.

Appendix 1. Kelp habitat density and algae species recording proforma

Diver 1 pre-prepares a dive slate for underwater recording at quadrats 1-5 as below for the KELP PARK and KELP FOREST. Diver 2 pre-prepares a dive slate for underwater recording as below but for quadrats 6-10.

KELP PARK Park max depth= Tx Depth =	1m	2m	3m	4m	5m
# Kelp > 50cm (species)	LH = SP= SL=				
# Kelp< 50cm					
#crust/echino/benthic fish to species level					
Dom Red algae					
Dom Brown algae					
% Foliose/ % Encrust					

KELP FOREST Tx Depth =	1m	2m	3m	4m	5m
# Kelp > 50cm (species)	LH = SP= SL=				
# Kelp< 50cm					
#crust/echino/benthic fish to species level					
Dom Red algae					
Dom Brown algae					
% Foliose/ % Encrust					

Appendix 2. Fish, echinoderms, crustaceans recording proforma

Diver slate to be pre-prepared for underwater recording as follows:

Dive site: ***Time:*** ***Kelp park max depth=***	*Kelp park transect depth =* *Kelp species:* *Forest/Sugar/Furbelows (circle)* *Rock/Boulder (circle)*	*Kelp forest transect depth =* *Kelp species:* *Forest/Sugar/Furbelows (circle)* *Rock/Boulder (circle)*
BW Ballan wrasse		
CuW Cuckoo wrasse		
GS Goldsinny		
RC Rock cook		
CoW Corkwing wrasse		
TP Tompot blenny		
BF Butterfish		
SF Scorpion fish		
LG Leopard spotted goby		
Other fish - name		
EC Edible crab		
VC Velvet swimming crab		
SC Spider crab		
LB Lobster		
Other crustaceans		
SS Spiny starfish		
Other starfish		
Common urchin and size(cm)		

Appendix 3. Fish identification aid

BALLAN WRASSE (30-60cm)
Single long dorsal fin

CORKWING WRASSE (15-25cm)
'comma' line behind eye, black spot in middle of tail stalk

GOLDSINNY (12-18cm)
Black spot on topside of tail stalk

ROCK COOK (12-15cm)
Blue lines on face and dark bar across tail

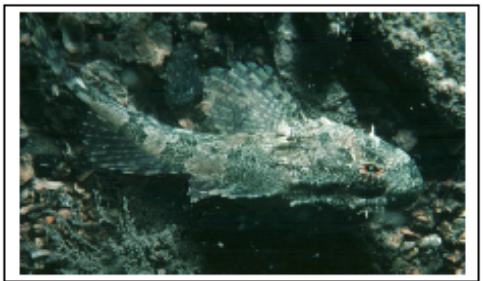
CUCKOO WRASSE (Max 35cm)
Female: Orange, Black/white spots along back
Male: blue head lines

LEOPARD SPOTTED GOBY

TOMPOT BLENNY

BUTTERFISH

SEA SCORPION
Mottled pattern,
colour changes to match
LONG SPINED has
a mouth barbel and
one long spine on cheek,
SHORT SPINED does not.



Appendix 4. Kelp communities recording form

Cyfoeth Naturiol Cymru
Natural Resources Wales

Date:	Recorders:	Time in:	Recorders:	Time in:	Recorders:	Time in:
	Kelp Park	**Kelp forest**	**Kelp Park**	**Kelp forest**	**Kelp Park**	**Kelp forest**
Dive site:	Tx depth:	Depth:	Tx depth:	Depth:	Tx depth:	Depth:
	Tx length:	Tx length:	Tx length:	Tx length:	Tx length:	Tx length:
	Max kelp depth:		Max kelp depth:		Max kelp depth:	
Kelp species						
Ballan wrasse						
Cuckoo wrasse						
Goldsinny						
Rock Cook						
Corkwing wrasse						
Tompot blenny						
Other fish						
Edible crab						
Velvet swimming crab						
Spider Crab						
Other crustaceans						
Spiny starfish						
Common urchin						
Urchin size (cm)						

Appendix 5. Algae species records

Algae species records at Martins Haven west, High Point and North Wall by Francis Bunker 7th July 2024.

Site	Martins Haven W	Martins Haven W	High Point	High Point	North Wall	North Wall
Kelp zone	Kelp park	Kelp forest	Kelp park	Kelp forest	Kelp park	Kelp forest
Substrate	Bedrock, boulders, cobbles and pebbles	Bedrock and boulders	Bedrock and boulders	Sloping bedrock	Sloping bedrock	Steep bedrock
Depth	13.4 m	8 m	9.5 m to 12.5 m	5 m	10 m	5 m
Apoglossum ruscifolium	p	-	p	-	-	-
Bonnemaisonia asparagoides	p	p	p	-	-	-
Calliblepharis ciliata	p	p	p	p	p	
Callophyllis laciniata	p	p	p	p	p	p
Compsothamnion thuyoides	P	-	p	-	-	-
Corallinaceae	-	p	p	-	p	P
Cryptopleura ramosa	P	p	p	P		P
Cutleria multifida	-	-	p	-	p	-
Delesseria sanguinea	P	p	p	p	p	p
Desmarestia ligulata	-	-	-	-	p	-
Dictyopteris polypodioides	p	p	p	p	p	-
Dictyota dichotoma	p	p	p	p	p	-
Drachiella heterocarpa	p	-	p	-	p	-
Ectocarpaceae	-	p	-	-	-	-
Erythroglossum laciniatum	-	p	p	-	p	p
Halopteris filicina	-	p	-	p	-	-
Heterosiphonia plumosa	p		p		p	-
Kallymenia reniformis	p	p	p	-	p	p
Laminaria hyperborea	O	C	-	-	-	-
Membranoptera alata	-	p	-	-	-	-
Meredithia microphylla	-	-	-	p	p	p
Monosporus pedicellatus	p	p	-	-	-	-
Palmaria palmata	-	-	-	-	-	p
Phycodrys rubens	-	-	-	-	-	p
Phyllophora crispa	-	p	p	p	-	-
Plocamium	p	p	p	p	p	p
Polysiphonia elongata	-	-	p	-	-	-
Polysiphonia fibrata	-	-	p	-	-	-
Rhodophyta	-	-	p	-	-	-

Site	Martins Haven W	Martins Haven W	High Point	High Point	North Wall	North Wall
Kelp zone	Kelp park	Kelp forest	Kelp park	Kelp forest	Kelp park	Kelp forest
Substrate	Bedrock, boulders, cobbles and pebbles	Bedrock and boulders	Bedrock and boulders	Sloping bedrock	Sloping bedrock	Steep bedrock
Depth	13.4 m	8 m	9.5 m to 12.5 m	5 m	10 m	5 m
Rhodymenia ardissonei	-	p	p	p	p	-
Saccharina latissima	R	-	R	-	-	-
Saccorhiza polyschides	R	C	O	-	0 to F	-
Schottera nicaeensis	-	-	-	-	p	-
Scinaia	p	-	-	-	-	-
Sphondylothamnion multifidum	p	p	-	-	-	-