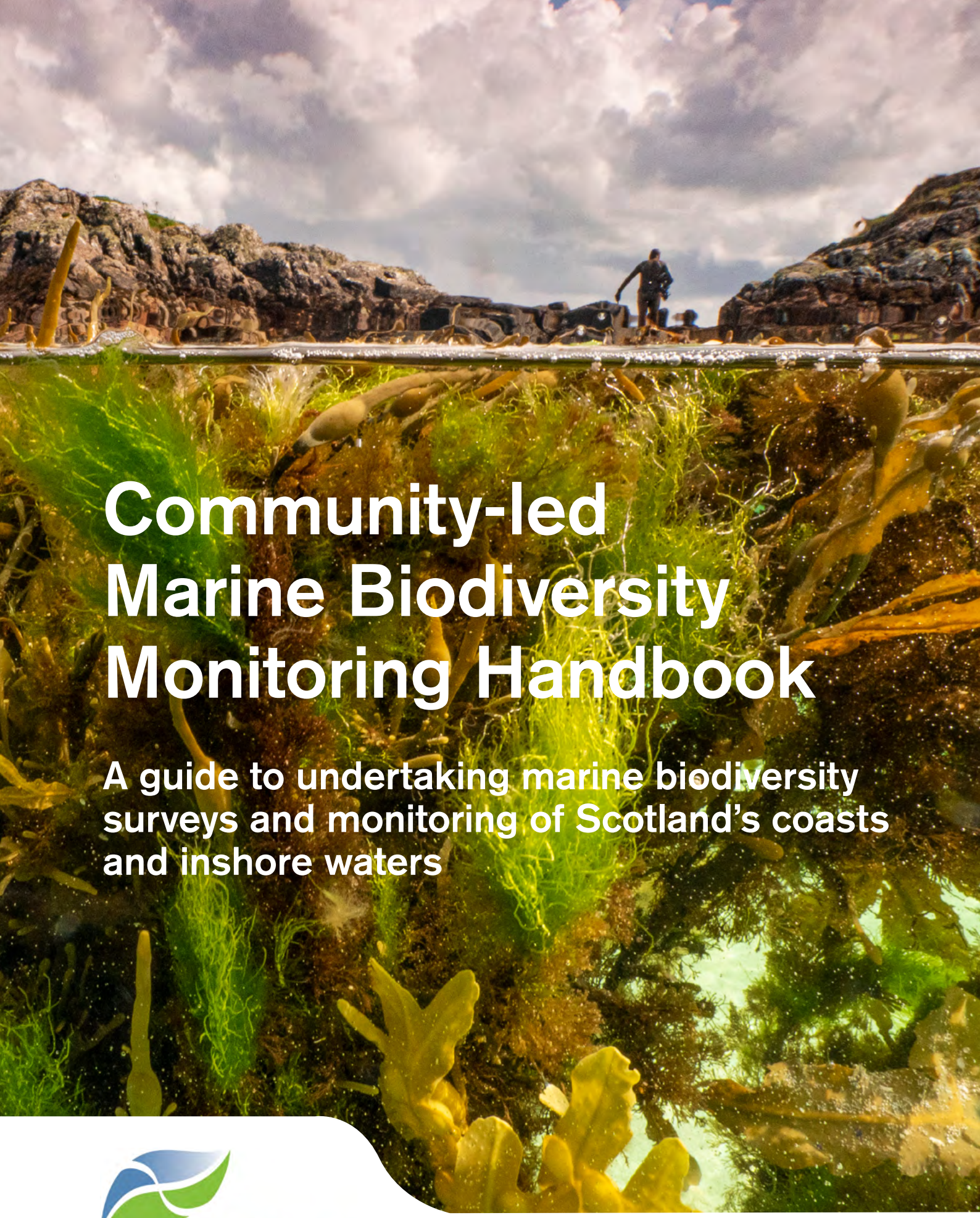

Community-led Marine Biodiversity Monitoring Handbook

A guide to undertaking marine biodiversity surveys and monitoring of Scotland's coasts and inshore waters

NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

FAUNA & FLORA INTERNATIONAL

WILLIAM GRANT FOUNDATION

A joint publication by NatureScot, Fauna & Flora International and community groups and individuals within Scotland involved in the Community-led Marine Biodiversity Monitoring project.

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A man and mixed seaweeds on a sandy seabed. Cairns of Coll, Scotland.

© Mark Kirkland

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Contents

Community-led marine biodiversity monitoring

The community-led marine biodiversity monitoring project encourages everyone to get involved in marine survey and raise the profile of Scotland's seas and its amazing biodiversity. Specifically, the project will help people record and monitor the marine life they discover in their local waters.

People around Scotland are keen to be involved in marine survey and promote the stewardship of our marine environment. Whether you are involved in a coastal community or local environment group, work on the sea, or visit and recreate on or near the water, this resource will provide all you need. We have created a suite of marine biodiversity survey methods and guidance, tailored to community needs, capabilities and access to survey equipment.

Engaging with marine survey and monitoring can have many benefits for participants as it does for the environment. This resource was co-created with communities and local groups to shape and deliver community-led marine surveys in Scotland.

The benefits of undertaking community-led marine biodiversity survey & monitoring include:

Environmental value

- Increasing knowledge and understanding of natural environments and processes
- Raising awareness of current issues in the marine environment
- Informing policy and management plans
- Contributing to the evidence-base to advise decision makers
- Acting as an early warning of changes to the marine environment
- Identifying threats to marine systems

Community value

- Collecting useful information about the local marine life
- It's fun
- Promoting connections with people that share similar interests
- Connecting with nature
- Providing materials to create educational resources
- Learning new skills and experiences
- Promoting ocean stewardship and builds community connections
- Participating in marine science and conservation

The Scottish Marine Protected Areas (MPA) Monitoring Strategy recognises the important contribution collaborative and citizen-led science programmes can make to the growing evidence base used to support good decision making for our marine environment.

The handbook is intended to be a working document which will be reviewed periodically. The project is funded by the William Grant Foundation* and we are working in partnership with Fauna & Flora International to enhance participation in community collection of marine data, through the surveying and monitoring of local coasts and inshore waters.

**The William Grant Foundation is a non-profit association established to support charitable causes in Scotland. Its work is funded by William Grant and Sons Ltd.*

◀ A grey sea slug (*Aeolidia papillosa)* in a small rockpool. Linne Mhuirich, Loch Sween.
©Ben James/NatureScot

Scotland's rich waters

Scotland's coasts and seas are among the most biologically productive in the world. They support an estimated 8,000 species of plants and animals – and up to 40,000 species if you include microscopic organisms. New species are still being discovered, particularly in deeper waters to the north and west.

Scotland's coastline and seas are an extraordinary environment to explore, hosting an array of wildlife – from the critically endangered flapper skate to vast kelp forests, basking shark feeding grounds and delicate maerl and flame shell beds. Our waters contain over a third of the global population of grey seals, the world's most northerly resident population of bottlenose dolphins, while our seabed habitats contain natural carbon stores and provide many life supporting functions.

The Scottish Government's vision for our seas is to have "clean, healthy, safe, productive and biologically diverse marine and coastal environments that meet the long-term needs of people and nature". To help achieve this vision, a network of Marine Protected Areas (MPAs) has been established as part of a strategy to conserve our living seas and coastlines in Scotland and currently covers over 22% of Scottish waters. Communities have played a key role in the development of the MPA network and continue to be at the forefront of marine conservation efforts throughout Scotland.

There are over 200 sites in the Scottish MPA network for nature conservation purposes, designated to protect nationally important marine wildlife, habitats, geology and undersea landforms.

A well-managed network of MPAs will:

- *Protect important marine habitats and species*
- *Deliver benefits for our marine environments*
- *Support communities*
- *Help sustain marine industries*
- *Provide recreational uses*

Scottish Ministers adopted a list of 81 marine species and habitats characteristic of the Scottish marine environment. Collectively known as Priority Marine Features (PMFs), the list includes a wide range of habitats and species including flame shell beds found in our coastal waters, cold-water coral reefs in our deeper seas and mobile species such as minke whale and basking shark. The PMF list is used to focus conservation efforts in Scotland. You can find some information on PMFs within this handbook within habitat and species information on page 87.

How to use this handbook

This handbook is split into six chapters and covers the information required to undertake marine biodiversity survey and monitoring in Scotland. In this handbook we provide a guide to survey planning and getting started safely, a range of survey methods and specific operational guidance for survey equipment and techniques.

Before you set off into the field to survey, the getting started chapter is a compulsory read to help ensure you survey safely and get the most out of your efforts. This chapter will provide guidance to build a community survey project, help you select survey methods and introduce the different survey equipment you may require.

The survey methods are focused on surveying and documenting marine life and features in the intertidal and/or subtidal zone, aimed at filling in knowledge gaps and highlighting where PMFs are found. They have been created with a range of difficulty levels, perfect for participants of all experience levels and developing your survey skills.

You can also find some information on habitats and species of interest for Scottish marine survey and monitoring, guidelines for good data management and much more. At the back of the handbook you will find the recording forms for each survey method, ready to be printed to take into the field.

Surveying anywhere along Scotland's coast will provide data to document the presence, range and extent of the marine life in our waters. The data you collect can make a valuable contribution to inform future marine management decisions.

All pages with a print icon are designed to be printed and taken on survey with you.

▼ COAST volunteers using an ROV to survey the seabed.
© COAST

Getting started

Before you head to the coast or sea you need to do some initial planning to make sure that you prepare yourself, are clear about what you want to record, have the right equipment and have a group of willing volunteers to undertake the survey activity. In this section we will cover the basic elements of survey planning.

Anybody interested in community-led marine monitoring in Scotland should read through this section. Undertaking marine survey can be hazardous and it is important that you consider the conditions you will be working in and have the right equipment and people for data to be collected efficiently and accurately. Time spent planning out your survey, using the contents of this resource, will massively improve your likelihood of successfully recording marine data.

This chapter includes:

- Setting up a community monitoring project
- Safety
- Impact on the environment
- Location
- Choosing a survey method
- Survey timing and frequency
- Equipment overview
- Survey planning - common sense checklist
- Quality control

◄ **Eggwrack (*Ascophyllum nodosum*) on barnacle encrusted rock. Loch Long, Scotland.**

© Mark Kirkland

Setting up a community monitoring project

If you want to get involved in monitoring your local marine environment, we recommend you complete a project profile to describe and plan your community monitoring project. Here you can plan your survey interests and explore why you want to get involved and what you want to achieve. We have provided a template for you to get started - see community project profile form in the appendix on page 100.

Once completed, a copy of this should be sent to the community-led marine biodiversity monitoring project officer at communitymarinesurvey@nature.scot.

When setting up a project, these points are key to ensuring a successful survey or monitoring project:

1. **Keep it simple**

   Don't set yourself too many objectives and at too high a difficulty.

2. **Time available**

   Your community monitoring project should be set up considering how much time you have available to spend surveying.

3. **Consistency**

   It's important that you follow the same survey methods each time you survey.

4. **Keep it FUN!**

   Your surveys should be enjoyable and fun to get involved in. We suggest you break-up and rotate more repetitive survey roles. You could make the day more fun by including a social barbeque or a similar get-together at the end or by linking with other events such as a beach clean.

5. **Regular monitoring**

   After deciding how much time you have available, stick to your monitoring regime. This could be weekly, monthly, seasonally or annually.

6. **Objective not subjective monitoring**

   It is important to monitor exactly what is there as it is, with no bias.

7. **Knowledge and briefings**

   It is important that everyone participating knows what they are doing and why and to feedback the results of any work to those taking part.

8. **Data lifecycle**

   Marine monitoring is not just about the fieldwork. Good data management practices will allow your data to be shared within your community and further.

▼ **Little Loch Broom Marine Life survey group undertaking a rocky shore survey.**
©Caitlin Orr/NatureScot

Safety

What to consider

- Undertake surveys in groups so you have help if anything goes wrong.
- **Carry a mobile phone** so you can make an emergency call. In Scotland, call emergency number 999 for police, ambulance, fire service or coastguard.
- **Inform a designated 'safety person' of your survey plan, location and timings.** Check in with them on your return. This person may need to contact emergency services if you don't return or if something goes wrong.
- **Always check the tide and weather forecast.**
- For using boats, always **follow coastguard recommendations** for safety.
- **Complete a risk assessment** – *template provided in the appendix.*
- Adult supervision is required if children are involved.

Intertidal

- **Check tide times** when you plan your survey. Intertidal survey should be undertaken within two hours before low tide.
- Intertidal habitats often have a complex topography, with algae cover creating an **uneven slippery surface.** Care should be taken, keeping hands free to avoid slipping and falling. Wear sturdy boots and move slowly and steadily.

Subtidal

- For snorkelling or water based activities, a **dedicated supervisor** role is advised to monitor participant safety from the shore. Use a surface marker buoy to ensure you can be seen easily.
- **Check tide times** when you plan your survey. Slack water is the optimum time to undertake surveys (no tidal movement).
- **Find out about local water conditions, including currents and tidal regimes.** In sheltered areas or areas without a significant tidal regime surveying may be possible at any time of day. In sounds and channels currents are likely to be strong at times and surveying should only be undertaken in optimal conditions.

Safety tips

- After touching marine life, **always wash hands before eating.**
- Keep an eye on sea and weather conditions for intertidal or subtidal surveys. Be aware of potentially dangerous waves when on the shore.
- **Always undertake surveys within your experience and limits.** If you are uncomfortable with the survey plans and/or conditions, DO NOT undertake any survey work. The survey can be rescheduled for a later date.
- Take water / hot drink and snacks.
- **Wear appropriate clothing and plan for all weather conditions.**
- Have a first aid kit available.

If snorkelling or wading never enter the water alone and ensure you have a dedicated survey supervisor on watch. Use a surface marker buoy (SMB) when snorkelling so you can be clearly seen. Ensure snorkelers are strong swimmers and have previous experience snorkelling in Scotland before task loading while undertaking a survey. GPS devices should be stored in a waterproof bag and towed when snorkelling, this can be attached to the SMB. Never attach any equipment to your person - this is a hazard that can lead to you becoming entangled. **Complete a risk assessment.**

Undertake snorkelling at your own risk.

Bad weather - conditions to stop surveying

Thunder and lightning storm

Strong water currents (presence of any current should be avoided for snorkelling or kayaking)

Reduced surface visibility (heavy rain)

Strong wind

Large swell or waves

Poor underwater visibility

Extreme cold

▼ Winter storm and crashing waves. Harris Bay, Isle of Rum NNR, Scotland.
© John MacPherson/NatureScot

Impact on the environment

Seashore etiquette

- Tread lightly. Try to avoid trampling marine life, such as walking through seagrass beds.
- If you remove any marine life for identification, please return the plants or animals to where you found them. This includes returning them to the same conditions (i.e. under an algae canopy, under a rock or within a rock pool).
- When overturning stones or boulders, it's vital that they are replaced as you found them.
- Leave only footprints and take only photographs. Please ensure you take all your belongings and rubbish away.
- See any debris in the sea or shore? Why not give a little back to our seas by removing any plastic or debris and recycling it. However, if an animal has made a glass bottle its home, best leave it there!

Boats

- Ensure adequate water depth to avoid damage to benthic habitats due to contact with the bottom of the boat or propeller.
- Ensure that anchors and/or chain do not impact on sensitive benthic habitats (e.g. shellfish beds, maerl and seagrass).
- Don't allow waste to enter the water.

The Scottish Marine Wildlife Watching Code

If you are out surveying and looking for marine life you should follow the Scottish Marine Wildlife Watching Code. Please see www.nature.scot/marinecode for more information.

Principles

Be aware. Before you go wildlife watching, learn about the animals you might encounter. Understand how your actions could affect them. Be alert to the signs that animals make when they feel threatened. Be observant, patient and sensitive to the interests of the wildlife you are watching.

Take responsibility for your own actions. Constantly assess the wildlife's reaction to your presence and, if you see signs of disturbance, move away quietly. Consider how much time you spend watching animals. The presence of people over long periods can be disturbing, however careful you may be.

Have respect for other people, wildlife and the environment. Use your right of responsible access wisely. Respect the privacy and livelihoods of those who live by the sea. Leave the environment as you find it.

The Code provides more details about animal behaviour, how to recognise signs of disturbance, and how to minimise the impacts of your activities, as well as information on marine wildlife and the law.

Biosecurity

Avoid spreading non-native species – thoroughly wash all kit following Check Clean Dry biosecurity principles. Whenever you leave the water or coast, remember to Check Clean Dry. Visit www.nonnativespecies.org/checkcleandry for more information.


STOP
THE
SPREAD
Invasive plants and animals harm the environment and block waterways. They can be small and hard to spot so are easily spread on damp clothing and equipment.
Protect the environment you enjoy:
CHECK
Check your equipment, boat, and clothing after leaving the water for mud, aquatic animals or plant material. Remove anything you find and leave it at the site.
CLEAN
Clean everything thoroughly as soon as you can, paying attention to areas that are damp or hard to access. Use hot water if possible.
DRY
Dry everything for as long as you can before using elsewhere as some invasive plants and animals can survive for over two weeks in damp conditions.
Find out more about invasive plants and animals and how you can help to stop the spread at:
nonnativespecies.org/checkcleandry
Department for Environment Food & Rural Affairs
The Scottish Government
NNSS
ANGLING TRUST
RYA
BRITISH CANOEING

Location

You can get involved in survey and monitoring of marine life anywhere around our coastlines and inshore waters. Understanding Scotland's marine environment and recording changes to it are important wherever you are in Scotland.

The Marine Protected Area (MPA) network covers approximately 22%* of Scottish waters so you may find your local area is within a designated site. Whether your local marine area is inside the network or not, there is amazing marine life to be discovered. Collecting data on what's in our waters is vital to improving our understanding and management of Scotland's marine environment.

Want to find out if there is a community monitoring site established in your area? Check out what marine survey community groups are active in your area. A good place to start is www.nature.scot/communitymarinesurvey. Alternatively; get in contact with the community monitoring project officer at communitymarinesurvey@nature.scot.

Intertidal

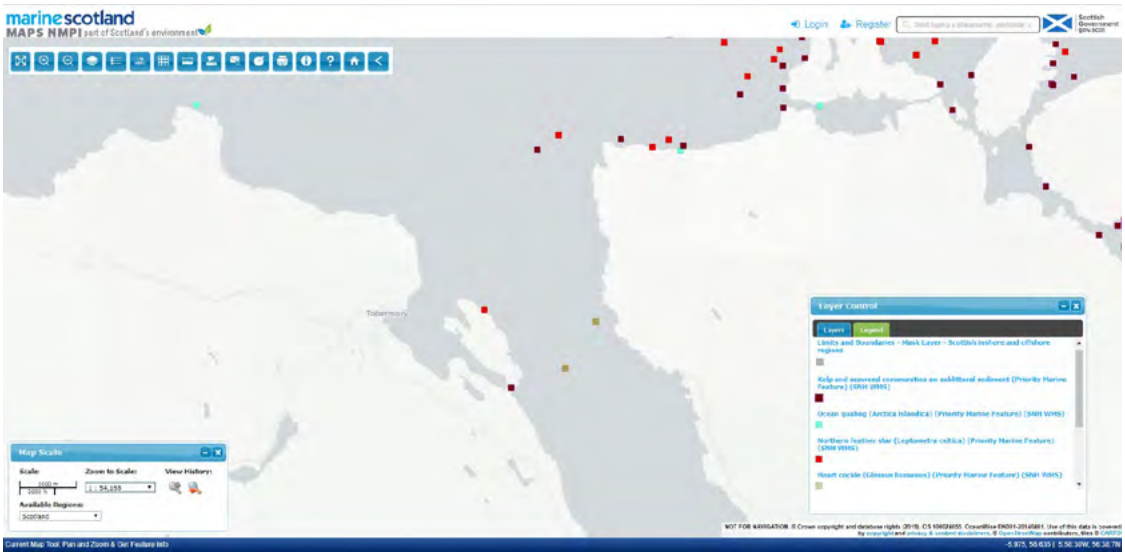
- Before you decide where to go, investigate what surveys have already been done in the area. If you are looking for a shore to survey, check if there is already a monitoring station established in your area. You may be able to add to work that is already taking place.
- If there are no established survey sites in your area, we recommend doing some background research on the known species and habitats, what the environmental conditions are, and what human activities have or are currently taking place in the area.
- Think about the accessibility of the shores you are interested in looking at and the practicalities of getting to and surveying them.

Subtidal

- The subtidal seabed is more difficult to access than our coastline and hence we know less about what is under the surface of the water. Scotland's seas cover an area greater than 400 000 km², over five times the size of Scotland's land mass. It is of great value to explore areas of the seabed where there are knowledge gaps.
- Resurveying areas where we have existing records is equally as important to detect any changes in the presence, extent and condition of marine habitats.
- If you are planning a subtidal survey, research what data is available for the area.

Check out Marine Scotland's National Marine Plan interactive to display marine data (including species and habitat data, MPA boundaries and much more.). See data layers within the 'Healthy and Biologically Diverse' layer options.

**22% MPA coverage in Scottish waters, Scottish Government, https://www.gov.scot/policies/marine-environment/marine-protected-areas/.*



▲ Screen grab of Marine Scotland's National Marine Plan interactive (NMPi).

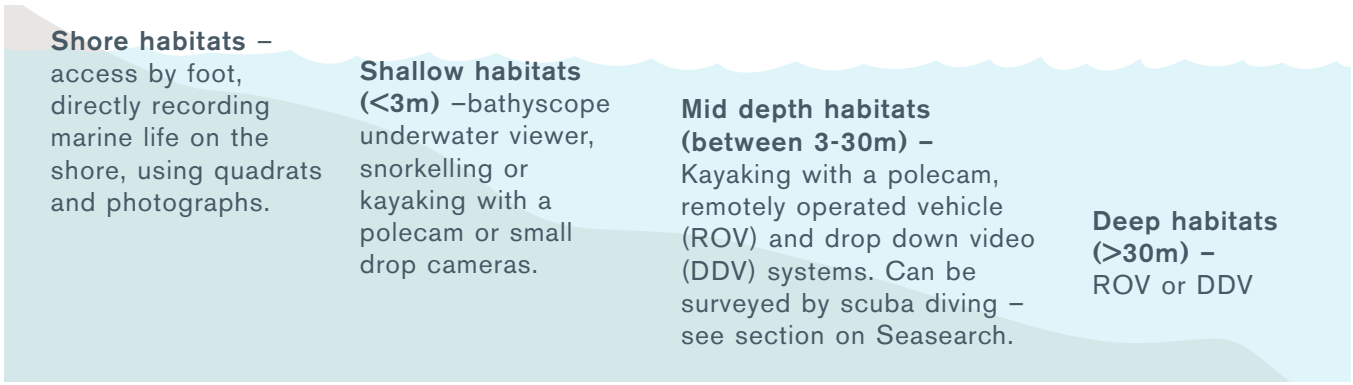
Choosing what to survey

Choosing what to survey will depend on a number of considerations:

- Do you want to look at the shore (intertidal) or underwater?
- If underwater, what is the water depth?
- How easy or difficult do you want the level of survey to be?
- What type of equipment do you have available?

Below we have categorised marine habitats by their water depth and identified the corresponding approaches and equipment you can use to collect marine life data. More information on the equipment can be found in the survey equipment section on page 21.

What to survey by habitat depth:



The next two diagrams show which survey methods could be used if surveying on foot or using underwater survey equipment, together with the level of complexity for the different survey options. For the full list of equipment required refer to the specific information about your chosen survey method. Guidance for the use of the survey equipment is provided within operational guidance on page 73.

▼ Shore habitats: survey methods which can be completed on foot (in blue)

Difficulty Level	Intertidal	Subtidal
EASY	1.1 Species image library	
	1.2 Photo station	
MODERATE	2.1 Rocky shore zonation	
ADVANCED	2.2 Rocky shore profile	
	2.3 Rocky shore quadrat sampling	
	3.3 Feature focus: habitat mapping	When intertidal plant and animal beds are present
	3.4 Feature focus: habitat quality	

▼ Underwater: survey methods which use a polecam, DDV or ROV (in purple)

Difficulty Level	Intertidal	Subtidal
EASY	1.1 Species image library	
MODERATE		3.1 Underwater marine life observation
ADVANCED		3.2 Underwater video transect

The physical environment

This handbook focuses on methods to survey marine biodiversity. If you would like to survey the physical marine environment (such as water temperature, salinity, water clarity etc.) you can undertake measurements while out surveying biodiversity. We don't include further guidance on physical environmental monitoring within this handbook. We recommend doing some research online to find out more.

There are many programmes available to get involved in beach cleans, documenting what plastic you find on our shores and beaches. This is another type of marine survey that can be undertaken to complement your groups' aims and look after the marine environment. We recommend you use the Marine Conservation Society's Beachwatch programme, visit www.mcsuk.org/beachwatch/.

Seasearch

If you want to get involved in marine surveys when SCUBA diving, we recommend the Seasearch programme which is coordinated nationally by the Marine Conservation Society.

Seasearch is a project for volunteer scuba divers and snorkelers who have an interest in what they are seeing underwater, want to learn more and want to help protect the marine environment around the coasts of Britain and Ireland.

The main aim is to map out the various types of seabed found in the near-shore zone around the whole of Britain and Ireland. In addition Seasearch divers record what lives in each area, establishing the richest sites for marine life, the sites where there are problems and the sites which need protection.

Visit www.seasearch.org.uk for more information!

▼ **Seasearch diver undertaking a survey.**
©Ross Bullimore

Survey timing and frequency

Timing

The time when you do your survey will have an impact on what you find. Life in the sea is affected by seasonal changes in the weather and ocean conditions. This results in changes in the diversity of marine communities such as abundance of algae and juvenile animals such as seaweeds, mussels and barnacles. Marine habitats may undergo seasonal change at differing levels, with seasonal effects still not fully understood for all species. To identify long-term changes in marine habitats it is important to recognise the effects of seasonal change on your survey results.

Annual surveys

Surveys can be undertaken annually to get data on the presence and condition of marine habitats over longer time periods. It is important to undertake surveys at the same time of year in subsequent survey years, preferably within two weeks of the original survey date.

Summer species and habitat

The optimal survey window is summer for most habitats and species and it is best to undertake annual surveys during this time of the year. This will allow you to capture the marine life that is present in summer but dies back or hides more in winter.

An example of this is seagrass beds (*Zostera* spp.) which can undergo large annual and seasonal variation. The factors behind these changes are not always clear. Intertidal seagrass beds are often annual and can undergo complete dieback in winter, with recovery dependent on local seed supply.

Optimum survey window for surveying most seabed species and habitats

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter			Spring		Summer			Autumn		Winter	

Year round species and habitats

For habitats that are not so affected by the seasons it is possible to undertake surveys of these in winter, but bearing in mind the likely sea and weather conditions. Winter surveys, if appropriate to the species and habitats you are interested in, can make surveying easier, as seaweed that can entangle survey equipment (such as ROVs) will have died back in winter.

An example of a habitat that is suitable for year-round surveying is maerl beds. Although growth occurs mainly in summer, maerl is one of the world's slowest growing plants (around 0.55 mm/year) making it suitable for annual surveys in winter. Maerl beds are often easier to survey in winter because algal coverage in the summer can make it difficult to see the seabed and maerl. However, if you are interested in the other seaweed species associated with maerl beds you would need to survey in the summer when these are present.

Seasonal surveys

Surveys can also be undertaken seasonally to monitor seasonal changes in marine habitats. You can track the natural seasonal variation in a habitat, such as an increase in algae and plant communities in spring and a reduction in winter. However, it is important not to confuse seasonal variation with the effects of disturbance by something other than changing seasons. Surveying seasonally may provide a fuller dataset, which can help detect long-term data trends and help minimise misinterpretation. An example of this is an increased ability to detect changes in algae on a rocky shore that result from a storm event.

Furthermore, while seasonal variation occurs within a year, some marine habitats may undergo natural variation over a longer time period as a result of ecological processes influencing community dynamics. This needs to be considered when interpreting any results from long-term monitoring sites.

Long-term datasets

Undertaking annual monitoring of the marine environment can create long-term datasets that can be used as evidence in reports and raise awareness. The annual ORCA Watch by the Sea Watch Foundation is an example of a long-term annual monitoring project that has now been running for a number of years documenting orca sightings.

Frequency

Below are recommendations for the frequency of monitoring surveys. You can setup more than one monitoring site and undertake surveys annually or seasonally.

To monitor annual changes within a site:

– One survey every year. Subsequent surveys should ideally be within two weeks of the original survey date.

To monitor seasonal and annual variation within a site:

– One survey within each season every year (winter, spring, summer and autumn). Subsequent surveys should ideally be within two weeks of the original survey date.

Tidal cycle

Selecting a date for surveying must be done in consultation with local tide charts to ensure tidal conditions are appropriate for surveying. Intertidal activities should begin preferably two hours before the predicted low tide (allowing surveyors to work down to the low water line at low tide). However, it is also possible to undertake surveys starting at low tide, surveying from the low tide line up the shore. Subtidal activities should ideally be planned for the predicted slack water where there is no tidal movement (this occurs at the times when the tidal movement changes direction).

Survey equipment


© Roger Cottis/South Skye Seas initiative

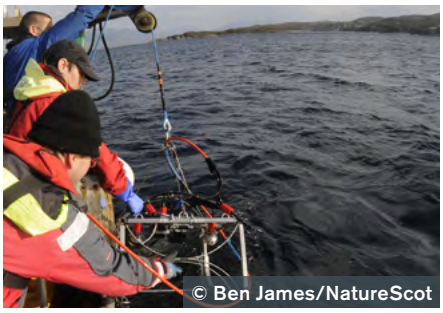
Bathyscope

A bathyscope is an underwater viewer that can be used from a boat or dry land, generally as a clear-bottom viewing cone. It works by eliminating both water surface glare and internal reflection, thereby allowing underwater viewing as far as water clarity and light will permit.

© Alex Perez/Unsplash

Compass

A compass is required for some surveys in this handbook to help describe site access and to record the direction of transects and features. Survey participants should know how to use a compass. Ensure they are used and stored away from metallic objects.


© Ben James/NatureScot

Drop down video

A drop down video (DDV) system is a video camera set within a robust frame that can be deployed using a rope or winch cable to survey seabed habitats. These systems typically have underwater lights, a depth sensor and sometimes use lasers to provide scale. A DDV system is usually deployed from a boat. The DDV is attached to the surface by a rope or winch and generally a tether is used to provide the live footage from the camera at the seabed. This can be viewed at the surface (on a tablet or laptop) and recorded. The GPS position of the DDV can be obtained from a hand-held device or the GPS system on the boat that it is deployed from.

For more information, please see drop down video system within operational guidance, page 75.

© Caitlin Orr/NatureScot

First aid kit

Ensure you carry a first aid kit with you on all surveys.


© Lorne Gill/NatureScot

GPS device

A Global Positioning System (GPS) device is the most effective and accurate way of determining your location. Many electronic devices such as mobile phones now have a GPS system in-built. However, depending on the kind of surveys and frequency, it may be best to purchase a GPS device as these can provide greater accuracy.


© Chris Leakey/NatureScot

Identification guides

Identification guides will be essential to correctly identify the marine life you find when surveying.

There are many identification guides available, some are targeted to a specific group of species, others covering a wide range of habitats and species. Guides are often either aimed at beginners or advanced users.

For intertidal surveys, the Field Study Council's fold out charts are great to use for on a rocky shore.

For subtidal surveys, the Seasearch identification guides are recommended.

It's also useful to refer to the habitat and species information chapter within this handbook, page 87, along with the NatureScot Flickr page for a wide range of habitat and species images at www.flickr.com/photos/naturescot/.

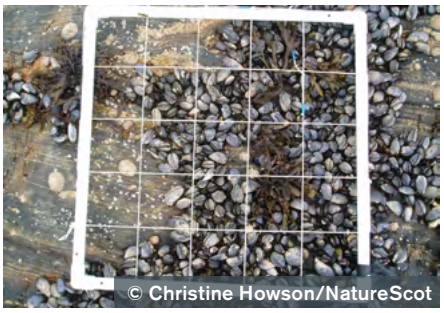
It's best to use a copy of different identification guides together.


© Caitlin Orr/NatureScot

Polecam

A polecam is a video camera that is deployed on a pole to view and survey the seabed. It can be customised to suit specific survey requirements, such as connecting a cable to the camera and a tablet or smartphone to view the footage in real time at the surface. A video camera can also be deployed on a rope to survey deeper seabed habitats. The GPS position of the polecam can be taken from a hand held device or from the GPS system on the vessel the system is deployed from. Some models of GoPro also have a built in GPS receiver to take the GPS location at the surface during deployment.

For more information, please see polecam within operational guidance, page 73.


© Christine Howson/NatureScot

Quadrat

A quadrat is a frame of a set size that is used in surveying to frame a set area to record from. They can be made to any size, but for the survey methods within this handbook we recommend using a 0.5m by 0.5m sized frame.

Quadrats can be easily made at home and from different materials (the size of the quadrat needs to be measured from the inside edge of the tubing or pipe).

- PVC bathroom piping with elbow connectors. This material means that the quadrat will not corrode in salt water and can be disassembled for travel and storage.
- Metal. Depending on the type of metal the quadrat may be prone to corroding. It could be welded together as a square frame or mounted with hinges to allow it to be folded.


© COAST

Remotely operated vehicle

A remotely operated vehicle (ROV) is a video camera set within a frame that has integral motors that enables the system to be piloted around the seabed by someone based at the surface. The ROV is typically controlled using a gaming controller, the pilot directing its movement both vertically and horizontally and the speed through the water. The ROV is attached to the surface by a tether so that the live footage from the seabed can be viewed on a screen (such as a tablet or laptop) at the surface and recorded. Additional positioning equipment can be added to the ROV so that its GPS position relative to mapped features is automatically recorded. This can be expensive so an alternative option is to approximate the position of the ROV from the position of the boat using a series of calculations to determine the position of the ROV relative to the boat. ROVs typically have underwater lights and a depth sensor fitted.

For more information, please see remotely operated vehicles within operational guidance, page 77.


© Owen McGrath/NatureScot

Survey forms

We have created survey forms for each survey method described within this handbook, see survey forms on page 117. Please complete these for your surveys, which will help to ensure all the relevant data is recorded.

We highly recommend that you store electronic copies of the physical survey forms from each survey undertaken by photographing or scanning them.


© Stocksnap.io

Tide tables and tidal predictions

Tide tables provide predicted tidal cycles and high and low water tide times. Tide tables for different areas are often available in a small booklet or widely available online (but generally only for 7 to 10 days in advance). Tide tables should be consulted at the time of survey planning. Undertaking surveys at the right time in the tidal cycle as described in the survey methods, such as low tide (intertidal surveys) or slack tide (subtidal surveys), is a particularly important factor in your survey plans.


© Ben James/NatureScot

Transect line

A transect line is used to measure a set distance of the shore which can then be used for surveys. In general we recommend that a survey using a transect is completed in an area 2m either side of the transect line.

The transect line should be laid out along the shore from the upper shore to the lower shore (nearest the sea).

Transect lines are available in different lengths, we recommend using 30m or 50m tapes (50m for the feature focus: habitat quality survey on page 139). The best tapes to use are in an open plastic frame with a simple winding handle; tapes that do not have metal parts will have a longer lifespan in the marine environment.

Survey planning - common sense checklist

- [ ] Have you identified any previous surveys in the area?
- [ ] Are you clear what you want to survey and where?
- [ ] Are you surveying at the recommended time of year?
- [ ] Have you checked tide times and weather?
- [ ] Do you have participants with the right level of expertise and experience for the survey selected?
- [ ] Do you have all the equipment required?
- [ ] Are all survey equipment clocks synchronised to ensure all time stamps match (such as time on a mobile phones, watch, camera equipment and GPS)?
- [ ] Are all batteries charged?
- [ ] Does the camera have space on a memory card and is it on the desired settings?
- [ ] Have you printed survey forms required and you have clipboards and pencils/ pens with suitable weather proofing?
- [ ] Do you have species identification guides ready?
- [ ] Have you prepared a 'clapperboard' to help identify video clips or photos during analysis?
- [ ] Have you produced a species checklist? This can be made with the known marine life you are expecting to find, or from previous survey data. Template in appendix, page 100.
- [ ] Do you have the right access permissions to survey the survey site (i.e. is the access site on someone's land)?
- [ ] When a boat is necessary, consider availability and access permissions of harbours and/or launching facilities.
- [ ] Do you have a first aid kit?
- [ ] Have you completed a risk assessment?
- [ ] Have you familiarised yourself with the survey methods?
- [ ] Have the survey participants had a survey briefing?
- [ ] Do you have quality control measures in place?

Quality control guidelines

1) Read and familiarise yourself with the methods before the day of the survey. Discuss them with the survey participants and speak to the survey leader if you need further assistance.

2) Print the required methods from this handbook and take a copy with you to the survey. Ensure that these are followed closely.

3) At the beginning of all surveys, all participants should be briefed on the day about the survey plan. The survey briefing summary provided within each survey method may assist with a survey overview. Make sure everyone is happy with what they are meant to be doing.

4) One person in the survey group should be identified as the quality control person – this person is likely to be most experienced with the method and most familiar with the species. This is a role that can be shared by more than one person.

5) During the survey, a quality control person can spot check observations and assist with identification.

6) Have identification guides available in the field and use as required. No identification guide will have every possible species so we suggest you use a few different guides.

7) Only identify marine life within your knowledge and skills, don't feel pressured into identifying species and habitats if you are uncertain.

8) Make sure you use a consistent GPS format to ensure you can revisit the exact fixed points on subsequent surveys. The preferred format is WGS84 with the position recorded in decimal degrees (as an example: 57.493723, -4.201847).

9) Ensure survey recording sheets are complete.

10) Have a team member check your survey recording forms. Make an electronic copy after your survey by photographing or scanning the survey recording forms.

11) Enter data into a spreadsheet/database as soon as possible after completing the survey. Check that this has been recorded and entered correctly (i.e. are the latitude and longitude in the right place, does the species recorded inhabit that environment?).

► **Anemones (*Sagartia elegans*) growing around a sponge in shallow waters in tidal rapids in Loch Sween.**

©Ben James/NatureScot

Methods

This chapter of the handbook provides the specific guidance on how to complete each of the survey methods shown in the method matrix below, explaining what it can be used for, the equipment needed and any other general considerations. Each difficulty level indicates whether the method is considered 'easy', 'moderate' or 'advanced' to carryout, with these descriptors relating to the complexity of each method and the degree of experience required.

Difficulty levels:

- **Easy**

  Can be done by new volunteers

- **Moderate**

  Can be done by volunteers with some experience or volunteers under supervision by someone with experience

- **Advanced**

  Can be done by experienced volunteers with relevant training in using survey equipment .

Method matrix

<table>
<tr><th>Difficulty level</th><th>Intertidal</th><th>Subtidal</th></tr>
<tr><td rowspan="2">Easy</td><td colspan="2">1.1 Species image library</td></tr>
<tr><td>1.2 Photo station</td><td></td></tr>
<tr><td rowspan="2">Moderate</td><td></td><td rowspan="2">3.1 Underwater marine life observation</td></tr>
<tr><td>2.1 Rocky shore zonation</td></tr>
<tr><td rowspan="4">Advanced</td><td>2.2 Rocky shore profile</td><td rowspan="2">3.2 Underwater video transect</td></tr>
<tr><td>2.3 Rocky shore quadrat sampling</td></tr>
<tr><td colspan="2">3.3 Feature focus: habitat mapping</td></tr>
<tr><td colspan="2">3.4 Feature focus: habitat quality</td></tr>
</table>

◄ Community group surveying the seabed using a bathyscope.

© Roger Cottis/South Skye Seas initiative

1.1 Species image library

DIFFICULTY LEVEL
EASY

Introduction

Taking photographs of the marine life you find on your local seashore and in the waters will help you to record what species there are in your area. The pictures you take can be stored, displayed and utilised for a range of purposes.

Creating your own species image library involves storing images and recording species or habitat names along with a GPS location. There are several options of online citizen science portals to submit and store your data, or alternatively you can store the data within your own community group.

Species images can also be collated to create a guide of the marine life within your local coasts and waters. This could be valuable to document the biodiversity on your coasts and waters will provide a visual guide to help others find and identify marine life when surveying.

▼ Yarell's blenny (*Chirolophis ascanii*), common star fish (*Asterias rubens*) and squat lobster (*Galathea strigosa*) hiding in a crevice off Orkney.

© Lisa Kamphausen/NatureScot

Method

1. Take a photo of a marine species or habitat using a smartphone or digital camera.
2. Ensure the date and time and GPS location of the image is saved.
   - **Using a smartphone:**

     This should be saved automatically with the photograph metadata – check your location services is turned on in your phone settings.
   - **Using a digital camera:**

     Ensure the time and date is set correctly on your camera. Some cameras may have built in GPS ability, if it doesn't use a device with GPS abilities to record your GPS location.
3. Save your image with the associated metadata (date, time, GPS location and who took the photograph and what did they use (i.e. model of smartphone/ digital camera) to a secure place.
4. Identify what species or habitat is in your image.

The GPS location should be in WG84 in decimal degrees (e.g. 57.493723, -4.201847).

Storing images and creating a species image library guide:

We recommend you store, organise and collate your images within your own community group if you want to create a community-led species guide to your local area. Check the copyright permissions of all images before use.

You can submit your species images and records to citizen science portals. Ensure you check the copyright permissions and privacy policies before use. Please see data management, page 93, for more information. You should only submit records via one data storage/sharing route to avoid duplication of records.

1.2 Photo station

DIFFICULTY LEVEL
EASY

Introduction

The purpose of a photo station is to document what you see on your local beaches and shores and any changes to them over time. It is as easy as taking a photo, writing down a little bit about what you saw, and recording your location so that you can find the same spot again in the future and take another picture.

The images you take and supporting information will provide insight into how our coastlines are changing over time. This data is valuable to environmental science generally, but particularly important as it creates a visual record of changes over time. A long-term time series can document biodiversity and geological changes that may have resulted from storm events and coastal erosion, for example, or record natural cyclical changes in habitats. This is where one habitat changes into another and back again over a number of years due to natural predator-prey or grazing dynamics (e.g. between seaweeds and urchins).

▼ Photographers photographing seabirds on the Isle of May National Nature Reserve.
© Lorne Gill/NatureScot

Survey briefing

Purpose

- Create a visual time series of an environment, habitat, or feature
- Observe changes through a time series of images

Overview

1) Choose a suitable and safe vantage point accessible at all times of the year and tides to capture a marine landscape and/or feature (e.g. a rocky shore headland, or a specific boulder).
2) Record your GPS position (GPS can be recorded through a smartphone app) and record the compass bearing of the direction at which your camera is pointing.
3) Record notes on access to the vantage point.
4) Return to the same location on subsequent visits, taking the same image and site information (we suggest you do this seasonally or monthly).
5) When returning to a previous photo station, check your GPS position and compass bearing are the same as the previous photo. Take a photograph of the feature, recording your GPS, the site information and conditions.
6) Over a long-term project, the photographs can be analysed to assess the changes of the habitat and/or feature over time by professionals.

Have you read the getting started chapter?

Ensure you follow:

- Quality control guidelines, page 26
- Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

- Photo station recording form, page 117
- Mobile phone or a digital camera
- Hand-held GPS/ Smartphone (if GPS is inbuilt)
- Compass (if not available on a smartphone)

How to setup the survey

1. Choose a suitable and safe vantage point from where you can clearly see your habitat subject/feature. Make sure that the site and frame chosen will give a good level of detail during different seasons and over a long period of time.
2. Record your GPS position (WGS84) in decimal degrees (e.g. 57.493723, -4.201847). This is your fixed point that you should return to each time you take a photograph at the site.
3. Fill out the survey and site information in the photo station recording form.

Technology

Smart phones store the GPS coordinates of a photo at the time it was taken at. This can later be recorded from the photo. Many also have built in compasses, registering this information at the time of taking a photo will give you a second reference of the GPS, the compass bearing of the photo and the elevation that the photo was taken from.

Survey method

1. Take several photographs of a habitat or feature (e.g. this could be a rocky shore headland or your favourite boulder).
2. Record a compass bearing to the middle of your photo (i.e. the bearing from where you are standing to the thing you are taking a picture of) so you know which direction to take the photo the next time you visit.
3. Each time you take a photograph – make notes about what you see on the photo station recording form.

Before you finish

1. Check all survey forms are completed fully.
2. Organise data and follow the data lifecycle – see data management section, page 93. Use the naming convention guidance in the appendix (page 111) for data and photo storage.

Return visits

Return to the exact point of previous trips and use the same methods and compass bearings to retake the same photograph, of the same feature on a regular basis. We recommend seasonal visits or after a big storm event. Remember to take a copy of a previously taken photo of your survey site – this will help ensure you are in the same position and are taking a photograph showing the desired frame.

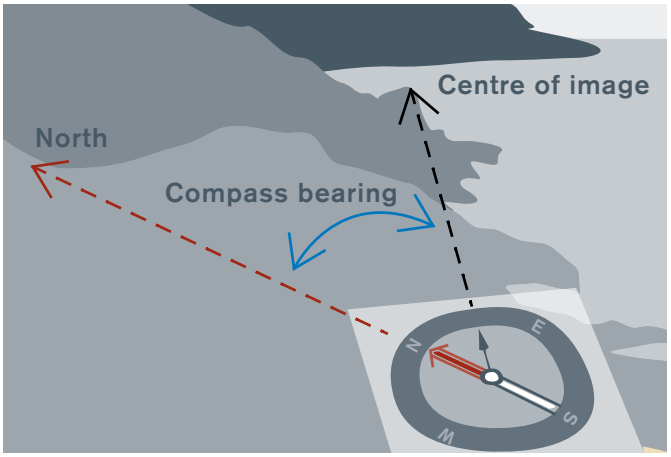
Tips for photography

When taking photos, minimise the amount of sky as this is not of interest.

Include permanent landmarks in your photos if possible to help assist with photo comparisons in the future or by others not familiar with the area.

Refer to previous photos each time to ensure that your return visit photos are captured from the same location.

▲ Loss of intertidal mussels at Caolas an Scarp, Harris.
© Michael Burrows/SAMS



◀ Taking a compass bearing from the centre of the image

2.1 Rocky shore zonation

DIFFICULTY LEVEL
MODERATE

Introduction

Rocky shores along our coastline are important habitats for many different marine plants and animals. In Scotland we have a large number of tide-swept, sheltered rocky shores and these have been classified as a Scottish Priority Marine Feature (PMF), page 87.

The purpose of a rocky shore zonation survey is to determine the different habitats present on the rocky shore by recording the substrate and main marine life cover present in each distinct habitat zone from the top of the shore down to the water's edge. This survey can be repeated seasonally or annually with special attention to recording the exact location of the habitat zone boundaries. Setting up a permanent survey site will allow participants to monitor any changes on the rocky shore.

The important element in the zonation survey is recording the most common and dominant marine life communities on the shore (such as barnacles on the upper rocky shore). If you would like to take this a step further to find and record the rarer marine life on your rocky shore as well, then we recommend using the rocky shore quadrat sampling survey (2.3).

We recommend when surveying a site that you complete the rocky shore zonation survey on three different transect lines within the area. This will better enable the data to be used to find trends by providing more replicates for statistical analysis.

To complement this survey, we recommend you complete the rocky shore profile survey (2.2). This survey records the incline and slope of the rocky shore and I provides physical data to support the biological information captured in the rocky shore zonation survey.

If you want to scientifically interpret the results of your survey effects, you should ensure you have professionals with the skills to do so involved in your survey group. Alternatively, look to team up with a university or academic who can put your work to use.

▼ Intertidal rocky shore transect. Loch Sunart.
© Jon Moore/NatureScot

Survey briefing

Purpose

- Find out what species of marine plants and animals live on rocky shores, and where
- Find out if the distribution of rocky shore seaweed communities is changing

Overview

1) Set up a transect line from the top of the shore to the low tide water line.
2) Record the exact position of this transect line by taking GPS coordinates and a photograph at the start and end point. Work down the line, and 2m either side of it, identifying the dominant seaweed species. These will change as you work down from the upper to lower shores as different seaweeds are adapted to survive in different environments.
3) Use the dominate seaweed canopy to determine the three zones on the shore – the upper shore, middle shore and lower shore.
4) Record the GPS position of each of these zones and the distance on the transect line.
5) Record the shore substrate and what the dominant marine life (such as the seaweeds) is in each zone.
6) We recommend you do this survey three times, setting out three transect lines within your survey site.
7) Optionally, with expertise, time and more survey participants you can build upon this survey with additional more difficult surveys, such as the rocky shore profile survey and the rocky shore quadrat sampling survey.

Have you read the getting started chapter?

Ensure you follow:

- Quality control guidelines, page 26
- Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

- Rocky shore zonation recording form, page 119
- Transect line (x3 if three transects undertaken simultaneously)
- Clipboard, paper and waterproof protector
- Camera
- Identification guides
- Compass
- First aid kit
- Tide tables
- Hand-held GPS/ Smartphone (if GPS is inbuilt)

How to set up the survey

1. Select a survey site.
2. Select a survey date – a day with a low tide of 0.4m or less is recommended.
3. Check weather and tides for the survey location and time.
4. Arrive at the survey site two hours before low tide.
5. Fill out the survey and site information in the rocky shore zonation recording form.
6. Lay a transect starting at the high water line (the high tide strand line at the top of the upper shore) towards the sea and the lower shore. The transect should drape down the shore towards the water in a straight line.

Record survey set-up

1. Record the latitude and longitude at the start of the transect, recording the compass bearing looking down the transect and the tape distance.
2. Record the latitude and longitude at the low water level and the tape distance. – It is best to do this when the tide is at its lowest point during the survey (at low tide) so this can be recorded during the survey.
3. You can take a photo of the transect line to jog your memory later on.

How can I tell which the main species are?

A dominant species will be seen without much searching. Looking at the habitat zone, the characterising species will be seen clearly by looking at the area (such as the algae canopy, identifying the seaweed present). A quick look under any algae canopy present will also be useful to characterise any dominant marine life living in or under the canopy. It's what you would say if you wanted to describe the habitat in 5 or 6 words.

Study the zonation of habitats (seaweeds will exhibit banding) on your shore. You are looking to identify the three rocky shore zones: the upper shore, middle shore and lower shore. Each zone will be characterised by a different dominating marine life community.

Zone characteristics:

1. **Upper shore**
   This is the area of the shore that is only submerged with water at extreme high tides. There is often a distinctive black band of lichens, with the appearance of some seaweed such as channelled wrack and spiral wrack. You commonly find rough periwinkles, limpets and barnacles.
2. **Middle shore**
   This zone has an increase in the quantity and variety of seaweeds. Typically seaweeds found are bladder wrack, knotted wrack and pepper dulse. You will also find more animals in this zone, such as dog whelk, top shells, limpets, barnacles and sometimes mussels.
3. **Lower shore**
   The lower shore is almost always submerged and only exposed at extreme low tides. The zone has an increase in red algae such as dulse, Irish moss and coral weed. Saw wrack (or serrated wrack) may dominate the upper part of the lower shore zone and kelps can dominate the lower part of this zone. You typically find more animals in this zone compared to the upper and middle shore, so we highly recommend you survey at the lowest tide possible (low water spring tides) to get fuller access to this zone.

Start at the top of the shore and begin the habitat zonation survey moving down towards the water (if you arrive at the shore two hours before the low tide). If you are delayed beginning the survey, it may be best to start surveying at the lower shore zone, before it gets covered by the tide.

Descriptions should be made of the substrate and main species within a 2m band either side of the transect line.

Survey method

Spend some time looking within a 2m band either side of the transect line for zonation within the seaweed community. For each zone, complete the following:

1. Record the tape distance and GPS position of each zone boundary, taking an image for reference.

   This should be completed at the:

   - Start of the upper shore
   - Boundary between the upper shore and middle shore
   - Boundary between the middle shore and lower shore
   - End of the accessible lower shore

2. Describe the main seabed substrate within a 2m band either side of the transect line.

   This could be

   - *Bedrock*
   - *Boulders*
   - *Cobbles and pebbles*
   - *Sand and gravel*
   - *Mud*
   - *Mixed ground*
   - *Other…*

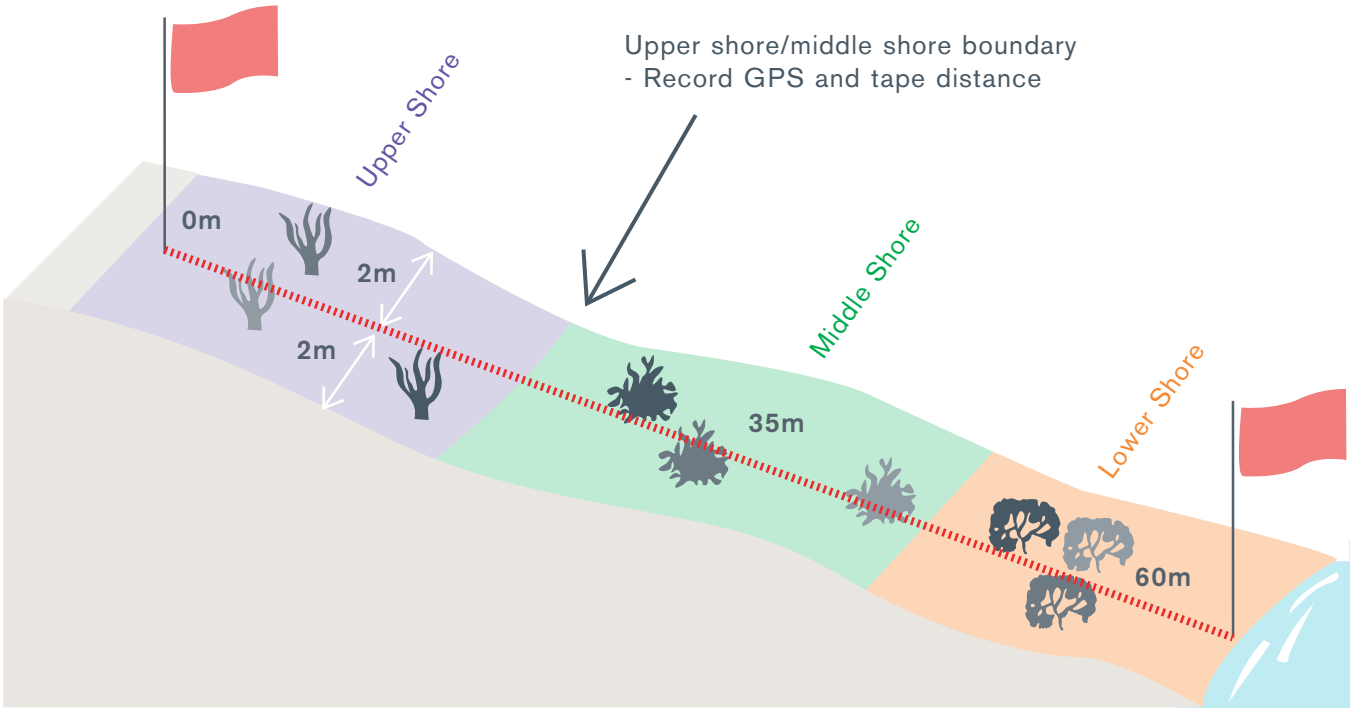
3. Describe the main marine life species within a 2m band either side of the transect line.

   Try to identify all visible species indicating the most dominant species, such as species of seaweed canopy.

4. Within each zone take some images where you can clearly see the substrate and main species.

It is important that you survey the lower shore at low tide.

▼ Rocky shore zonation survey diagram of shore zones within 2m either side of a transect line.



Before you finish

1. Check all survey forms are completed fully.
2. Remove all equipment from site.
3. Wash equipment in freshwater, allow to dry and store properly.
4. Organise data and follow the data lifecycle – see data management section, page 93. Use the naming convention guidance in the appendix (page 111) for data and photo storage.

Complete this survey on three transects within your survey site.

2.2 Rocky shore profile

DIFFICULTY LEVEL
ADVANCED

Introduction

The purpose of a rocky shore profile survey is to specifically collect data on the slope of the shore that you are surveying. This will give you a model of the shore profile which in turn can be used to illustrate the position of marine life on rocky shores.

The slope of the shore contributes to the physical environment that marine life inhabit. The steepness and fluctuations within the slope of the shore affect the environmental conditions and can create different microhabitats on a rocky shore such as rock pools, vertical faces, overhangs or gently sloping rock. On a steep shore there is a smaller area of habitat that will be exposed to the air at low tide, so a smaller area for intertidal species to settle.

As part of a long-term monitoring programme on a rocky shore, a shore profile will provide a base to display the marine life upon and help you to identify if there has been any changes to the marine life community within the permanent monitoring station.

A rocky shore profile can be undertaken on each transect surveyed within the rocky shore zonation survey.

▼ Community group recording shore height measurements at Dunstaffnage, Oban.
© Cecilie Dohm/Fauna & Flora International

Survey briefing

Purpose

– Create a shore profile of the physical gradient of the shore

Overview

1) The aim of this survey is to take measurements of the fluctuations in slope of the rocky shore coastline. This should be done on each transect to provide physical information that complements the biological community data you have already collected.

2) The most important point within this survey is to record low water reference point at the time of low tide and record the exact time of taking this shore height reading.

3) Survey timing. This survey should be completed by two additional surveyors at the same time as the rocky shore zonation survey on the same transect line setup. This is to ensure you can complete the survey at the time of low tide.

4) You will require a minimum of two people to complete this survey; one person to take readings of shore slope from a tripod and a second person to hold the measuring pole. A third person is recommended to assist the survey and communication between the two tasks.

5) This survey is focussed on taking shore slope measurements and requires some data handling mathematics to process the results and create a shore profile. This is a requirement to make data collected on the zonation survey more useful.

6) The surveyors level tripod should be setup higher up the shore than the start of your transect line to allow you to take a measurement of the start of the transect.

7) Take measurements of the shore height by reading the measuring pole height through the tripod viewfinder.

8) On a steep shore, if you're too high to see the top of the measuring pole when looking through the viewfinder, you'll need to move the tripod to measure the shore slope. When doing this it's important that the low water reference point is known, so all stations can be in reference of this. On moving the tripod, you will need to take a measuring pole reading from both tripod stations (where previous readings were taken from and the new tripod location).

9) Once completed, follow the data handling guidelines to produce a shore profile.

Have you read the getting started chapter?

Ensure you follow:

– Quality control guidelines, page 26

– Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

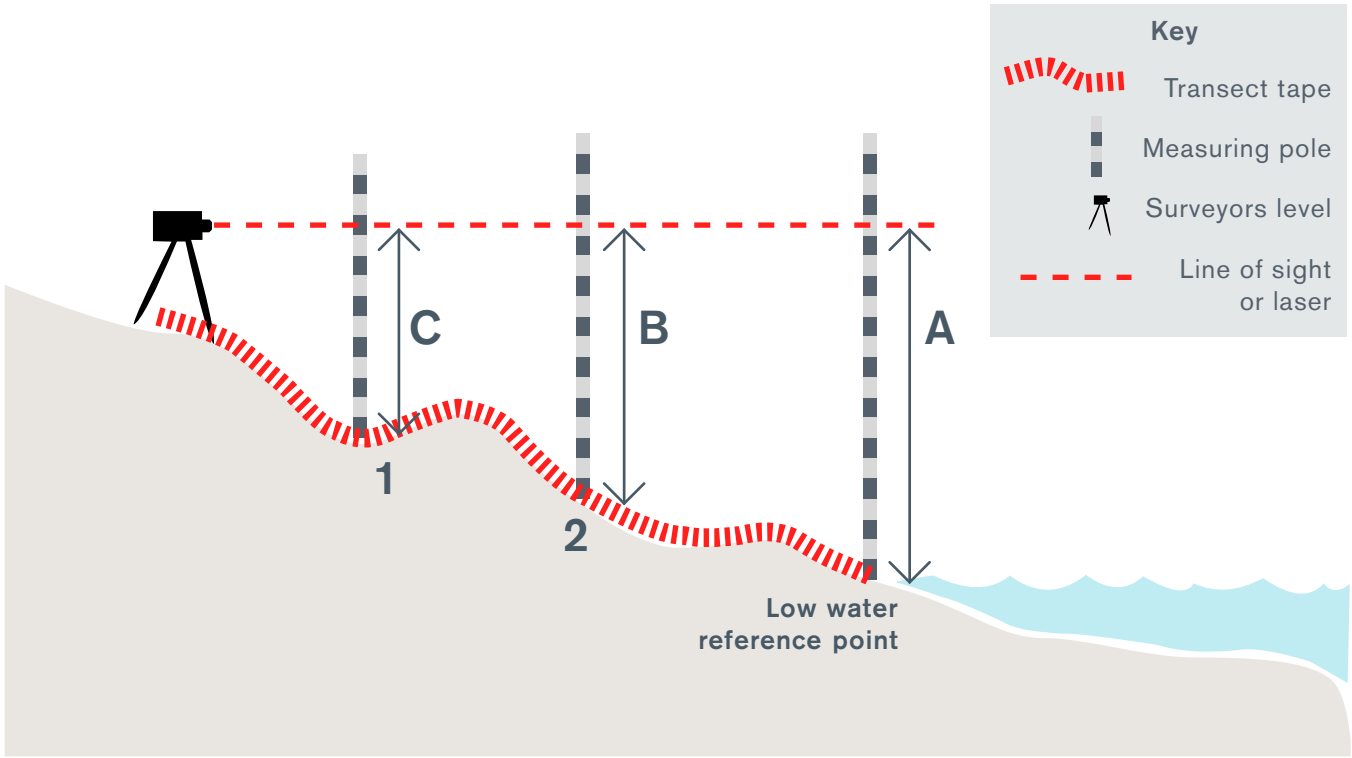
- Rocky shore profile recording form, page 123
- Surveyors level and measuring poles
- Transect line (same transect line used within the rocky shore zonation survey if that survey is undertaken)
- Clipboard, paper and waterproof protector
- Identification guides
- First aid kit
- Tide tables

How to set up the survey

Scenario 1: Gentle sloping shore

If the shore has a gentle slope you will be able to complete measurements of the shore from one tripod station location. The tripod should be placed on the upper shore, above the transect line to record shore slope.

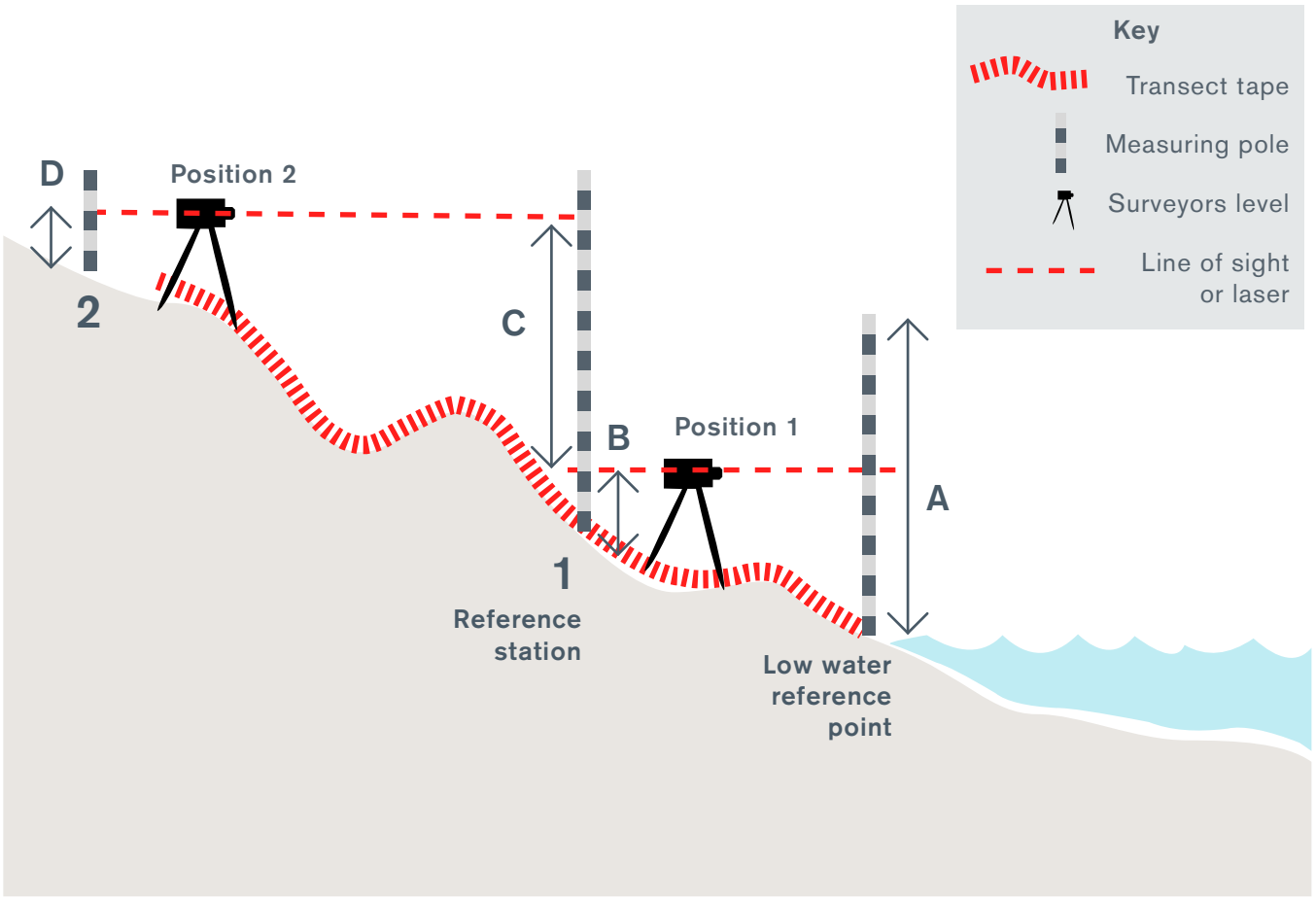
▼ **Gentle sloping shore. Arrows A, B and C indicate the measuring pole height readings. The low water reference point reading should be completed at low tide.**



Scenario 2: Steep sloping shore

If the shore has a steep incline then it will be necessary to move the position of the tripod station to record the shore profile of the full shore. The tripod should be placed on the upper shore, above the transect line to record the upper shore and placed in the middle shore to record the middle to lower shore area.

▼ **Steep sloping shore. Arrows A, B, C and D indicate the measuring pole height readings. In this setup note that measuring pole position 1 has two measuring pole readings – reading B recorded from surveyors level tripod position one and reading C recorded from position two.**



Moving the tripod - Setup scenario 2

If it is necessary to move the tripod you need to take two measuring pole height readings - one from the first tripod location and one from the second tripod location. This needs to be a point on your shore where it is possible to take a measurement from both locations.

1. Take a measuring pole reading of the reference station at tripod position 1.
2. Move the tripod to position 2.
3. Take a second measuring pole reading of the reference station from tripod position 2.
4. Record on the survey form.

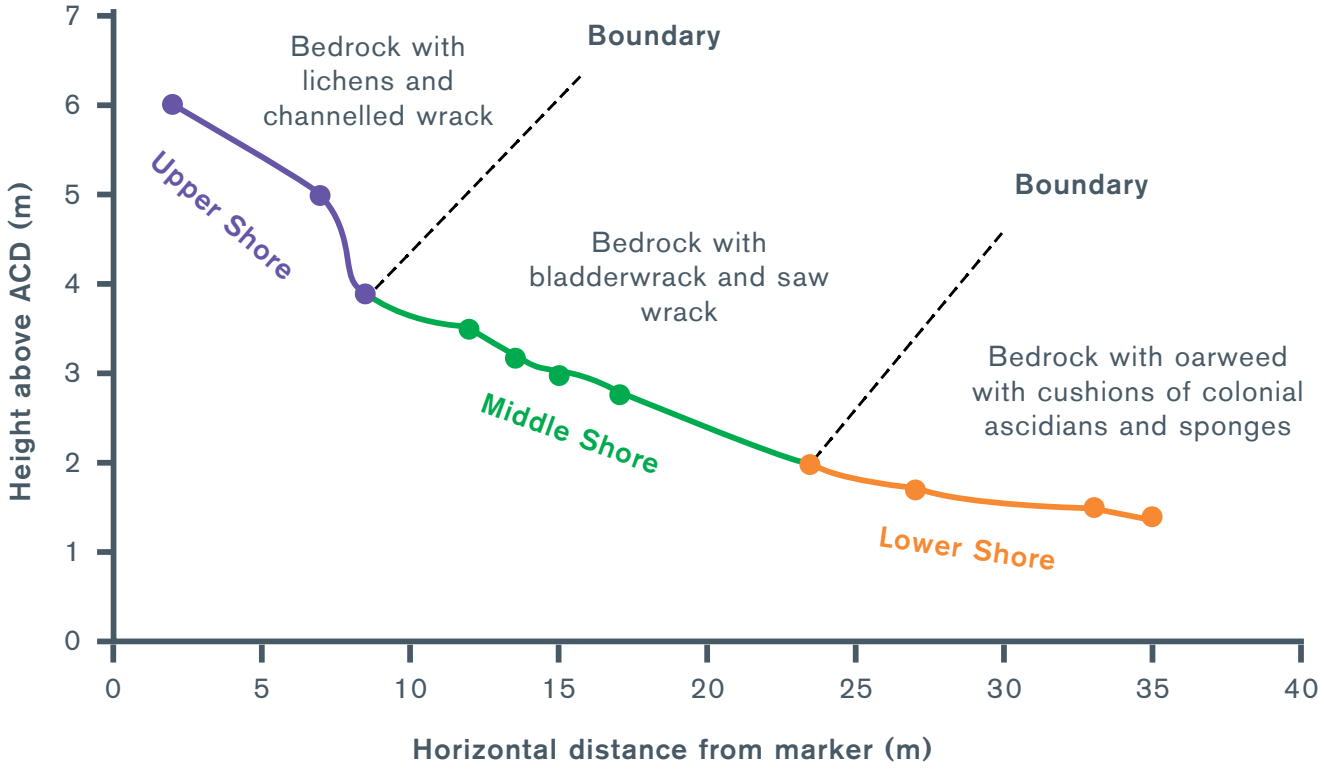
Survey method

All setup scenarios

1. The shore slope readings at the low water reference point should be recorded at the time of low-tide.
2. The survey should be completed on the transect line laid for the rocky shore zonation survey.
3. Set up the tripod and adjust so that the telescope or reading pole is level and the low water reference point is in view.
4. Take a measuring pole height reading of the **low water reference point**:
   - One person at the surveyor level tripod position looking through their gauge towards the measuring pole.
   - A second person should hold the measuring pole at the low water reference point (this should be at the end of the transect at the waterline where the land meets the sea).
   - The person at the tripod station should record the measuring pole height, time of reading, transect line distance and the tidal height (a third person would be useful to assist).
5. Continue to take measuring pole height readings by moving the measuring pole to rocky shore zone boundaries and at points of slope change.
   - Use your judgement to determine where to take additional measurements. Generally, where there is a noticeable change in slope.
   - Record measuring pole height and tape distance.
6. If the tripod requires to be moved position to record all features on the transect see section ***Moving the tripod*** - *Setup scenario 2* for details.

Before you finish

1. Check all survey forms are completed fully.
2. Remove equipment from site.
3. Wash equipment in freshwater, allow to dry and store properly.
4. Complete the data handling to create a shore profile from the survey measurement recordings.
5. Organise data and follow the data lifecycle – see data management section, page 93. Use the naming convention guidance in the appendix for data storage, page 111.



▲ Rocky shore profile.

Data handling to create a shore profile

Create a shore profile using the shore slope measurements recorded by converting the data into height above chart datum (ACD).

Setup scenario 1: Gentle sloping shore

Calculate the shore height above sea level (ASL) for each measuring pole reading.

Calculation:

ASL = height reading — low water reference station height reading.

This should then be transformed into height above chart datum (ACD), this can be calculated by using the tidal height at the time of the low water reference station reading.

Calculation:

ACD = ASL + predicted tidal height

Setup scenario 2: Steep sloping shore

Calculate the shore height for readings from tripod position 1 using the same methodology as *Setup scenario 1: Gentle sloping shore*.

Additionally, calculate shore height above sea level (ASL) for each measuring pole position reading from tripod position 2.

Calculation:

ASL= (reference point height C – height reading) + (Low water reference station reading – reference point height B)

This should then be converted into height above chart datum (ACD), this can be calculated using the known tidal height at the time of the low water reference station reading.

Calculation:

ACD = ASL + predicted tidal height

2.3 Rocky shore quadrat sampling

DIFFICULTY LEVEL
ADVANCED

Introduction

Quadrat sampling is a tool to study the ecology and biodiversity of a habitat. This is a passive form of sampling, done without removing the marine life found and provides a detailed record of species present within a known area while minimising impact to the habitat.

This survey is great to look in detail at a small area of a rocky shore, you will be amazed at the amount of different animals and plants you'll find within a small area.

The abundances and densities of marine animals can be calculated using the number of individuals found in a standardised quadrat area. Species such as barnacles, seaweeds, algae, and colonial animals such as sponges and lichens can be recorded in terms of their percentage cover.

We recommend when surveying a site that you should complete this survey on three different transect lines, with four quadrats surveyed per zone on each transect line (upper, middle and lower shore). This will allow the data to be scientifically analysed to interpret potential trends.

▼ Gridded quadrat made with PVC pipe and string.
© Chris Leakey/NatureScot

Survey briefing

Purpose

- Find out and identify what marine life is living on the rocky shore
- Calculate the abundances of the marine plants and animals you find

Overview

1) Survey timing. This survey should be completed by two additional surveyors at the same time as the rocky shore zonation and the rocky shore profile survey (optional). This is to ensure you can complete the survey within the time of low tide.
2) Work in pairs, with two people recording the same quadrat.
3) Survey four quadrats within each rocky shore zone (upper, middle and lower shore).
4) Survey both the seaweed and marine canopy and the species underneath by gently moving the seaweed to the side.
5) Record the percentage cover of colonial animals and plants and count the number of sessile animals, such as shells and crabs.
6) Use the rocky shore quadrat sampling recording form. We have provided common species you may find in each zone on the survey recording form which you can use as a checklist and add any additional species you find.

Have you read the getting started chapter?

Ensure you follow:

- Quality control guidelines, page 26
- Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

- Photo quadrat label template, page 110 (print on laminated paper or on a waterproof dive slate)
- Rocky shore quadrat sampling recording form, page 125
- 50cm x 50cm quadrats
- Hand-held GPS/ Smartphone (if GPS is inbuilt)
- Camera
- First aid kit
- Identification guides
- Clipboard, paper and waterproof protector
- White plastic tray to help identify species

How to setup the survey

You don't need to setup a new transect line for this survey as it can be completed on the same transect lines surveyed in your rocky shore zonation survey.

Quadrats should be placed haphazardly within each habitat zone, within 2m either side of the transect line (i.e. gently drop the quadrat behind you trying not to aim for or avoid specific habitat patches). We suggest you complete four quadrats within each habitat zone. Work in pairs to survey each quadrat.

1. For each quadrat sampled, use the quadrat label template to record the location, transect, zone and the unique quadrat identification number.
2. Photograph the quadrat with the label placed outwith the frame taking note of the time. Take the photo directly above the quadrat, the frame of the quadrat filling the image field of view, minimising shading in the frame and glare. Ensure the edges of the quadrat and the quadrat label are in the image and that it is in focus.

Survey method

A gridded quadrat can help with estimates of percentage cover of all colonial animals. A grid of 25 equal squares within a 50cm x 50cm quadrat should be used. Each square will account for 4% of the quadrat.

You should record all marine life within and underneath the seaweed canopy so percentage cover estimates can total above 100 percent.

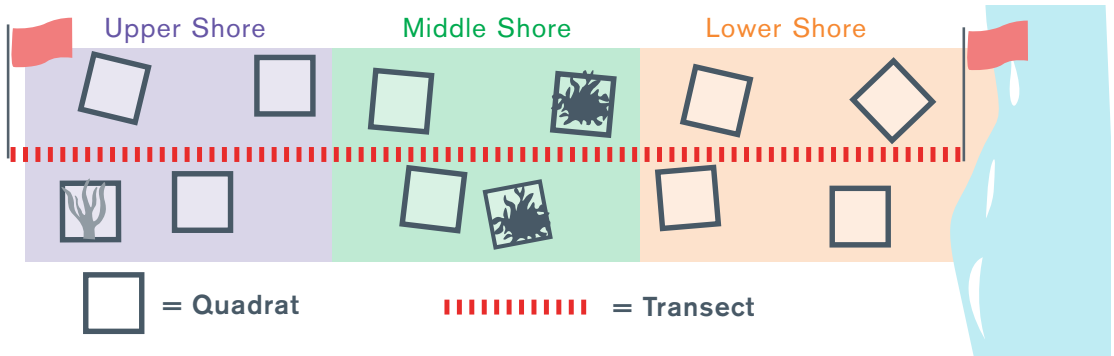
1. Identify all marine life species within the quadrat, ensure you survey the seaweed canopy and then move this aside to survey the marine life underneath.
2. Estimate % coverage of all barnacles, seaweed and algae, and colonial animals such as sponges and lichens in the quadrat. Percentages should be estimated down to 10%, below 10% record P for present.
3. Count individual non-colonial animals (such as shells, dog whelks and limpets).

Additional quality assurance

1. Working in pairs, each person should record data for each quadrat. Before finishing the quadrat, the results should be compared to ensure you both agree and have recorded the same results.
2. After reviewing results, you may continue to complete a new quadrat.

Before you finish

1. Check all survey forms are completed fully.
2. Remove equipment from the site.
3. Wash equipment in freshwater, allow to dry and store properly.
4. Organise data and follow the data lifecycle – see data management section, page 93. Use the naming convention guidance in the appendix (page 111) for data and photo storage.



▲ Placement of quadrats on a rocky shore.

3.1 Underwater marine life observation

DIFFICULTY LEVEL
MODERATE

Introduction

The purpose of this survey is to explore under the surface of the water and record the marine plants and animals present. This survey is designed to complement recreational marine activities such as kayaking and can be used to explore inshore waters using drop down video (DDV) or remotely operated vehicle (ROV) techniques.

With a focus on minimising detailed recordings while in the water, this type of survey will enable you to efficiently create a snapshot of the seabed and marine life you encounter at fixed points within your project area. This survey is great if you want to create an inventory of where marine habitats and species are located and can also identify areas where you may want to target a more detailed survey.

For this survey, you will generally need to get in or on the water and use some kind of camera system such as a polecam, DDV or ROV to take photographs or video recordings of what is under the surface. Alongside your images it is vital to record your survey metadata, so ensure you have the equipment to be able to record your GPS position, time and the depth of each observation.

▼ **Dead mans fingers on Madadh Beag, Loch nam Madadh. *Alcyonium digitatum* on infralittoral bedrock and boulders with jewel anemones and red algae just below the kelp zone.**

© George Stoyle/NatureScot

Survey briefing

Purpose

- Find out the distribution of species and habitats in inshore waters
- Record the exact location of underwater marine life

Overview

1) Get on the water in a kayak or boat using remote camera survey equipment such as a polecam, DDV or ROV systems. In shallow waters (<3m) this survey can also be undertaken using a bathyscope and a waterproof camera.
2) We recommend you lower your camera system in the water for around 2 minutes and record the seabed at each location you want to survey (survey stations). Each survey station will be a new underwater marine life observation record.
3) Record the metadata for each survey station (GPS position, depth, time etc.) - **this is the most important element!**
4) Describe what the seabed looks like including the seabed substrate, marine life cover and any marine species you encounter.
5) We recommend surveyors focus first on recording the observation metadata. If time permits also record what you see on the seabed but descriptions of the seabed can be added later when reviewing the footage.
6) Ensure the underwater marine life observation recording form is fully completed. Organise data using file naming conventions and following the data lifecycle – see data management section (page 93).

Have you read the getting started chapter?

Ensure you follow:

- Quality control guidelines, page 26
- Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

- Underwater marine life observation recording form
- Polecam, DDV, ROV system or a bathyscope with a waterproof camera
- Hand-held GPS/ smartphone (if GPS is inbuilt)
- Identification guides
- Clipboards, pencils and waterproof protector or waterproof slate (for use in wet conditions)
- Tide tables
- First aid kit
- Compass (for ROV use)
- Kayak, small boat, or other suitable vessels

How to set up the survey

1. Select a survey date –plan to undertake surveys around slack tide. *This will remove or reduce tidal impact.*
2. Plan the survey location and use the survey plan template to plan survey stations for more advanced surveys, page 104.
3. Check weather and tides for the survey location and time.
4. Prepare survey equipment.
5. Prepare GPS device (WGS84) – Either exact GPS using a GPS device in track mode or the GPS on a smartphone. Ensure GPS is set to record in decimal degrees (e.g. 57.493723, -4.201847).
6. Fill out the survey and site information in the underwater marine life observation recording form.

When using an ROV, follow ROV operational guidance. The ideal setup is to have the GPS position of the ROV displayed as a screen overlay on the video footage. If you do not have a GPS position screen overlay installed, the ROV's GPS position can be estimated. Additional field recording is necessary, see ROV operational guidance (page 77) in the appendix for details.

Slack water

Slack water is a short period of time when there is no tidal movement in either direction, typically one hour either side of high water or low water. This can vary locally though, so make sure to check local information (such as pilot books or tide charts). The time of slack water can be estimated using tide tables.

The absence of tidal movement will remove or reduce drag on polecam, DDV or ROV systems resulting in better quality imagery and more accurate findings. If currents are too strong the camera will not sink to the seabed, or tow you and your boat along with the current at too great a speed to record useful images.

Survey method

1. Follow operational guidance specific to your equipment such as polecam, DDV or ROV.
2. Lower the camera system in the water where you would like to create an observation record, start recording the seabed. You should record footage for no longer than 2 minutes. (we want to capture a snapshot of the seabed at one point, we don't want a long drift covering a large area).
3. Record the **time, GPS position** (WGS84 in decimal degrees) and the **seabed depth** when the seabed is in view.
4. Describe the main seabed substrate and marine life cover.
   Substrate options:
   - Rocky reef
   - Boulders
   - Cobbles and pebbles
   - Sand and gravel
   - Mud
   - Mixed ground
   - Wreckage
   - Other…
5. Describe the main seabed marine life cover.
   Marine life cover options:
   - Kelp forest
   - Kelp park
   - Mixed seaweeds
   - Encrusting pink algae
   - Seagrass bed
   - Maerl bed
   - Tall animal turf
   - Short animal turf
   - Animal beds (please state what type .....) e.g. flame shells, blue mussels
   - Sediment with life apparent
   - Barren sediment.
   - Other… (please state .....)
6. ***Optional step:*** *- Complete if you have additional survey participants.*

   Describe the marine life species present.

   Try to identify all visible species indicating the most dominant species. Please provide an estimate of the number of each species over the survey area in terms of a known area (e.g. Queen scallop: 1 per 1m²). If unable to determine, indicate P for present.

   This could include - seaweeds, sponges, starfish, brittlestars, feather stars, sea urchins, anemones, hydroids, sea slugs, bivalves, crabs, bryozoans, sea cucumbers, sea squirts, fishes.

Before you finish

1. Check all survey forms are completed fully.
2. Remove equipment from site.
3. Wash equipment in freshwater, allow to dry, and store properly.
4. Organise data and follow the data lifecycle – see data management section, page 93. Use the naming convention guidance in the appendix (page 111) for data and photo storage.

Species Checklists

Species checklists should be created before the survey listing the species that are common to the area or what you may expect to see. Any species not on the checklist identified when surveying can be added to the bottom of the checklist.

This will reduce the time taken to record all the species you see and will give you more time to focus on exploring! A species checklist template can be found on page 107.

3.2 Underwater video transect

DIFFICULTY LEVEL
ADVANCED

Introduction

The underwater video transect survey will allow you to collect data on a larger area of the seabed rather than a single point. This survey is usually undertaken by drifting on the sea surface in a kayak or boat. The camera on the seabed will likewise drift along the seabed and you can record a drift line transect.

In this survey you will record video transects (i.e. a straight line recording of an area) that can be used to determine what marine species are present on different areas of the seabed. This survey should be carefully planned and target specific areas you want to gain detailed information about such as the distribution of seabed habitats and associated species. Similarly to previous surveys, there should be an emphasis on collecting accurate and reliable metadata (GPS position, time, depth).

With additional considerations it may also be useful to estimate the extent of seabed habitats by detecting what marine species or features are present at carefully planned survey station locations.

Using an ROV to complete this survey is not recommended because it is challenging to manoeuvre an ROV to travel in a straight line. An ROVs direction of travel is affected by water currents, requiring a skilled pilot to control. We recommend you follow the underwater marine life observation survey for completing surveys with an ROV.

▼ Maerl bed in Caol Scotnish rapids with common and black brittlestars.
© Graham Saunders/Marine Scotland

Survey briefing

Background

Before beginning this survey, a comprehensive survey plan should be created using the survey plan template in consultation with any seabed biodiversity data available. You should have a clear survey area planned and survey stations with known GPS positions and assigned survey stations numbers/names. See the getting started chapter for survey planning considerations.

This survey should be completed using a polecam or DDV camera system deployed from a kayak (polecam) or boat (DDV), see operational guidance for the camera system you are using.

The two most important aspects of this survey are attention to recording accurate metadata and good image quality of the footage. Please consult the image quality operational guidance for more details. In particular, ensuring that the camera is moving over the seabed at a slow pace (<0.6 knots).

Purpose

- Find out the distribution of species and habitats in inshore waters
- Record seabed habitats along a transect

Overview

1) Prepare a clapperboard with station details and film at the beginning of each survey station.
2) Deploy the camera system at your planned survey station. On deployment, record the time, GPS position and depth, taking a waypoint on your hand-held GPS device.
3) Film the station for a maximum of five minutes with the camera slowly drifting along the seabed.
4) Observe and record the main seabed substrate and main marine life cover at the survey station. Describe any changes in habitat or species composition in the survey station description.
5) Take notes of what marine species you see, indicating how abundant they are (rare, occasional or common).
6) Occasionally land the camera or hold still over the seabed to get a good quality image of the seabed without movement. Post survey you may be able to extract a video still image at these intervals.
7) At the end of the survey station, record the GPS position, time and depth and take a waypoint on your hand-held GPS device before removing the camera system from the seabed.
8) Organise data and follow the data lifecycle – see data management section. Use the naming convention guidance in the appendix for data and video/ photo storage.

Have you read the getting started chapter?

Ensure you follow:

- Quality control guidelines, page 26
- Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

- Clapperboard template, page 112 – ensure it is waterproof
- Survey plan template, page 104 – *complete before the survey*
- Underwater video transect recording form, page 134
- Polecam or DDV system
- Hand-held GPS device
- Identification guides
- Clipboards, pencils and waterproof protector or waterproof slate (for use in wet conditions)
- Tide tables
- First aid kit
- Kayak, small boat, or other suitable vessels

How to setup the survey

1. Plan survey location.
2. Select a survey date – plan to undertake surveys around slack tide. *This will remove or reduce tidal impact.*
3. Check weather and tides for the survey location and time.
4. **Prepare survey plan – use the survey plan template,** page 104**.**
5. Prepare survey equipment.
6. Prepare GPS device (WGS84) – use the GPS device in track mode and ensure this is turned on for the duration of surveying. Ensure GPS is set to record in decimal degrees (e.g. 57.493723, -4.201847).
7. Fill out the survey and site information in the survey recording form.
8. Prepare a clapperboard with the survey information for the transect / survey station.
   - Print and laminate clapperboard template.
   - This should be filled in and updated for every survey station or recorded transect.

Filming setup:

- Please refer to the image quality operational guidance, page 81.
- The camera angle should face a ~45 degree angle to the seabed.
- The camera should be approximately 30cm – 1m from the seabed during filming.
- Recording of the transect will begin when the camera is close to the seabed.
- In most cases, underwater lighting will be required to improve clarity of footage.

Notes for filming:

- A GPS position captured on a screen overlay function is recommended.
- GPS waypoints should be created for the transect start and end.
- The GPS device should be in track mode for the whole period of survey (time at sea). *See GPS device operational guidance,* page 82.
- Ensure, where possible, that the direction of travel is in a constant compass bearing.
- Video footage should be recorded at a smooth slow pace to allow a clear image of the seabed (<0.6 knots).
- A video length of maximum 5 minutes is recommended.

Survey method

Polecam and DDV

The ideal setup is to have the GPS position of the polecam or DDV camera system displayed as a screen overlay on the video footage. If you do not have a GPS position screen overlay installed, your location can be recorded from the position of the deployment vessel. The camera will always be attached to the deployment vessel so the camera will be more or less below the vessel (the GPS position of the camera may be slightly different if the camera is at an angle in the water, however for the purposes of this survey this is within an acceptable margin).

ROV

Using an ROV to complete this survey is not recommended. This is because it is challenging to manoeuvre an ROV to travel in a straight line. An ROVs direction of travel is affected by water currents, requiring a skilled pilot to control. We recommend you follow the underwater marine life observation survey for completing surveys with an ROV.

Only complete this survey using an ROV in optimum conditions (including no underwater current) and if you are confident the ROV is travelling in a straight line.

Method – protocol

1. Follow the specific operational guidance for your survey approach – such as polecam or DDV.
2. Ensure your GPS device (WGS84) is recording your location in track mode.
3. Fill in the clapperboard and film it for around five seconds with the camera system (polecam, DDV, ROV), ensuring it can be clearly read before deploying the equipment to survey. If possible keep the film of the clapperboard in the same video segment as the survey station you are going to film (i.e. don't start and stop the video).
4. Deploy the camera system. Start recording the video transect data when the seabed is in view using the survey recording form. **Travel in a straight line and at a consistent depth where possible.**
5. Record all metadata at the start of the transect– when you first see the seabed. **Accurate metadata recording is the most important element of the survey.**
   - Take a waypoint on your GPS device
   - Record the **time**
   - Record the **GPS position**
   - Record the **seabed depth**
6. Record the **main seabed substrate** and **main seabed marine life cover** found together in the transect video.

Substrate options:

- Rocky reef
- Boulders
- Cobbles and pebbles
- Sand and gravel
- Mud
- Mixed ground
- Wreckage
- Other…

Marine life cover options:

- Kelp forest
- Kelp park
- Mixed seaweeds
- Encrusting pink algae
- Seagrass bed
- Maerl bed
- Tall animal turf
- Short animal turf
- Animal beds (please state what type .....) e.g. flame shells, horse mussels
- Sediment with life apparent
- Barren sediment.
- Other…(please state .....)

This should be the main substrate and marine life cover you see at the same time in the full video transect. If they change, record the most common in the video and describe any changes observed in the description for that station.

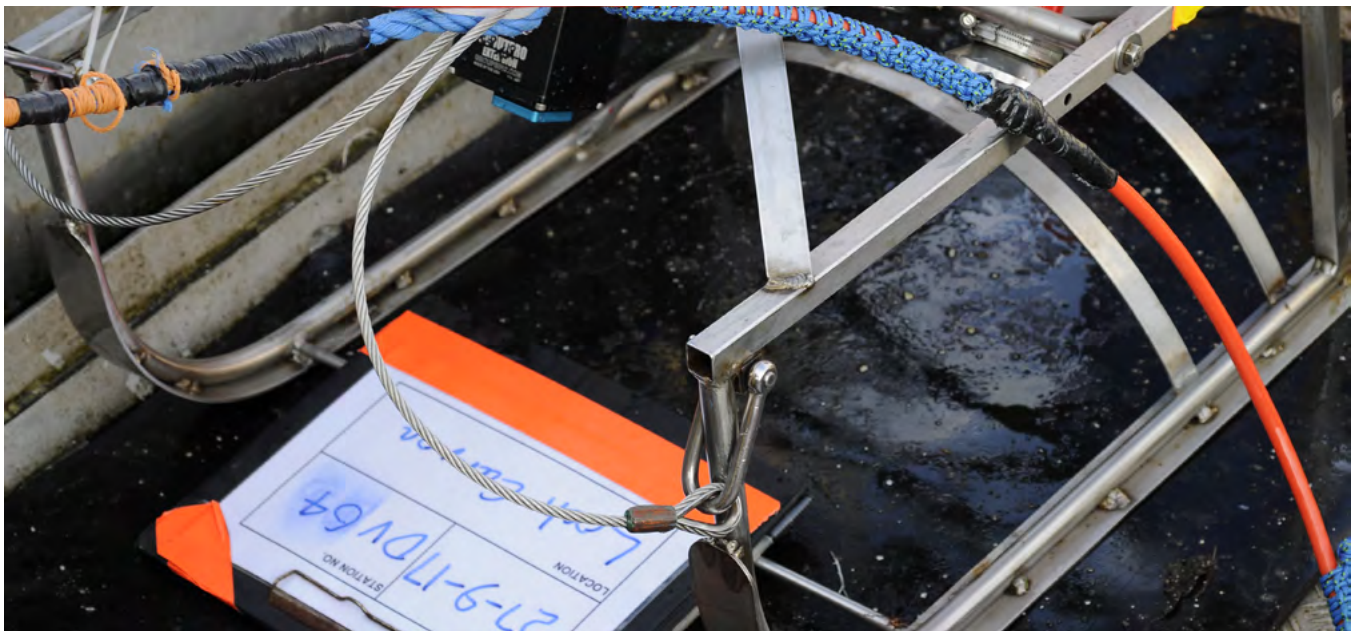
7. **Take a video still -** Land the camera system on the seabed to capture a 2 to 3 second recording the seabed without movement. Additionally, take a still photograph if possible with your camera system.
8. Describe the **marine life species** present.
   Try to identify all visible species indicating the most dominant species. Please provide an estimate of the number of each species over the survey area in terms of a known area (e.g. Queen scallop: 1 per 1m²). If unable to determine, indicate P for present.
   This could include - seaweeds, sponges, starfish, brittlestars, feather stars, sea urchins, anemones, hydroids, sea slugs, bivalves, crabs, bryozoans, sea cucumbers, sea squirts, fishes.
9. After 5 minutes end the video transect. Record all metadata at the end of the transect – before retrieving the camera system from the seabed.
   - Take a waypoint on your GPS device
   - Record the **time**
   - Record the **GPS position**
   - Record the **seabed depth**
10. Retrieve the camera system. End video recording.
11. Complete this survey method for each survey station planned using the same survey recording form.

Before you finish

1. Check all survey recording forms are completed fully.
2. Remove equipment from site.
3. Wash equipment in freshwater, allow to dry, and store properly.
4. GPS device coordinate file showing polecam or DDV track and waypoints should be downloading from the device and stored. You should refer to this after the survey to verify the correct GPS positions were recorded on your recording forms.
5. Ensure all data (video files, recording forms, GPS tracks etc.) are labelled appropriately using the correct naming convention are stored appropriately so the data can be accessed and used in the future. Use the naming convention guidance in the appendix (page 111) for data and photo storage.
6. Organise data and follow the data lifecycle – see data management section, page 93.

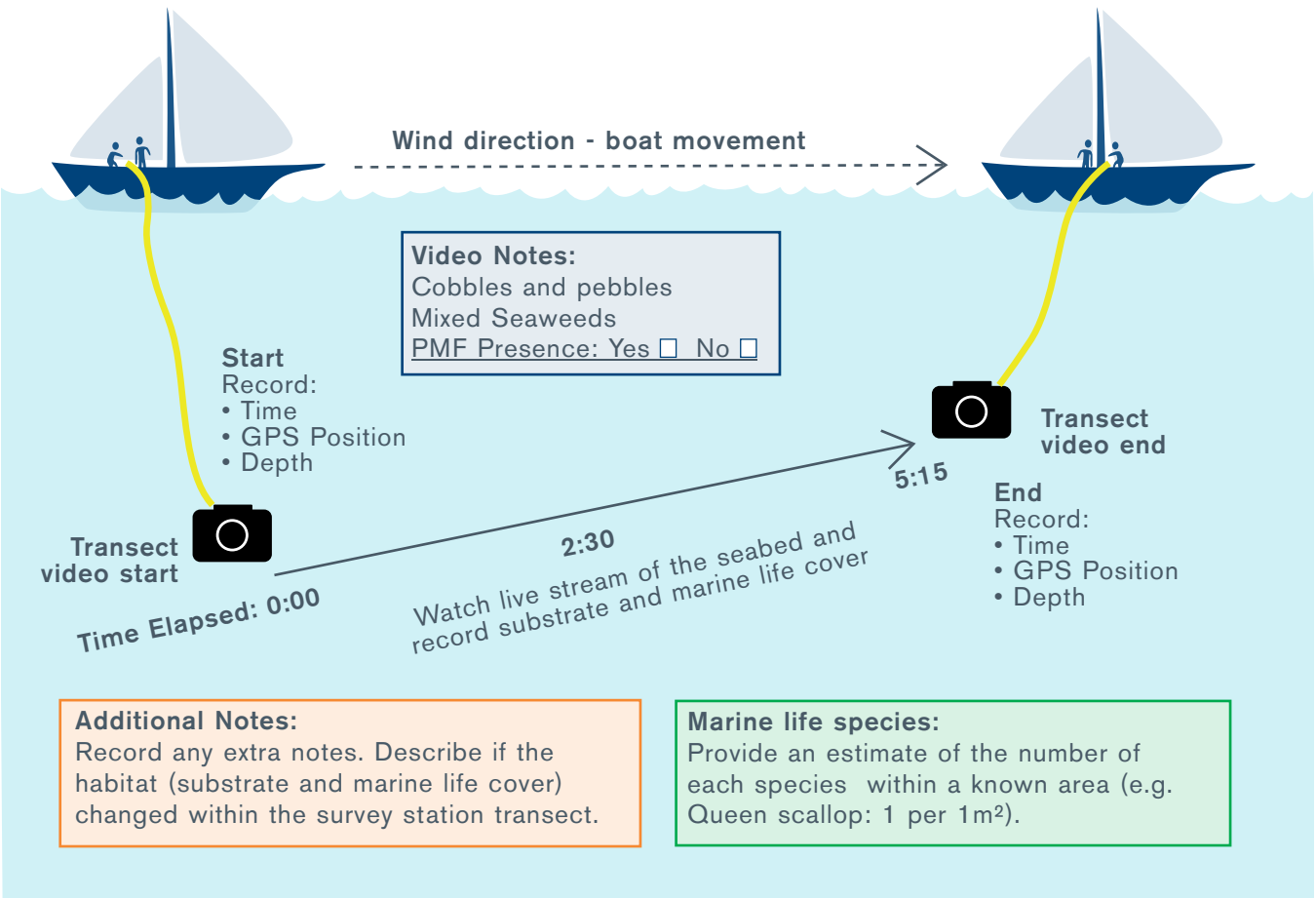
▼ **Close-up of a drop down video system. A clapperboard was used at the start of each remote video clip.**

© **Ben James/NatureScot**



Video stills

We recommend that you land the camera occasionally to get a close up of the seabed while the video camera is not moving – i.e. a “video still”. On reviewing the footage, you can take a screen grab. Use the naming convention guidance in the appendix for data and photo storage.



▲ Diagram of the underwater video transect method.

3.3 Feature focus: habitat mapping

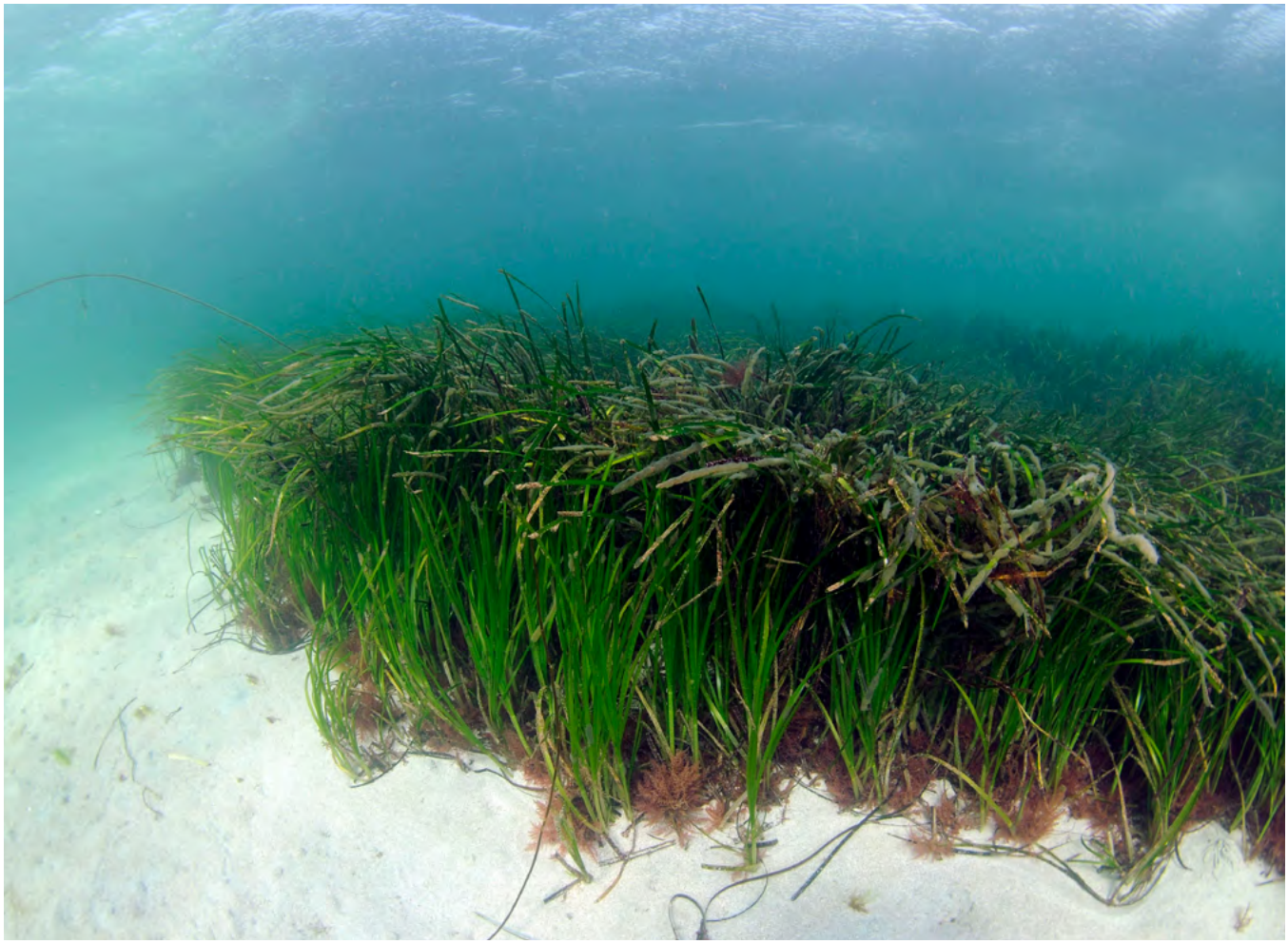
DIFFICULTY LEVEL
ADVANCED

Introduction

The purpose of the habitat mapping survey is to find out the size of a habitat by mapping the habitat boundary. This will enable you to keep a visual record of a feature of interest and monitor any changes over time. The feature must be intertidal or in shallow water that can be clearly seen using your eyes when exposed at low tide or snorkelling (generally 3m depth or shallower).

In this survey you will track the boundary of a feature, gaining data on the extent of the habitat. You don't need to map every inch of your local seabed and intertidal area. This method is designed to enable communities to develop an overview map of particular habitats and marine life of interest within your area.

▼ A shallow *Zostera marina* seagrass bed in the Sound of Barra.
© Ben James/NatureScot



Survey briefing

Purpose

– Get an estimation of the habitat size

Overview

1) You must be able to clearly see the seabed and identify the substrate using your own eyes. This survey can be carried out in the intertidal zone or shallow water, typically less than 3m depth.
2) Plan a habitat you would like to map (e.g. a seagrass bed or kelp forest).
3) Choose a date and time with suitable tidal conditions, such as a low tide to access as much of the bed as possible (spring low tides are preferred).
4) Determine the feature boundary, using a GPS device on track mode, moving around the boundary of the habitat.
5) At regular intervals, take additional waypoints on your GPS device of the boundary, taking photographs as evidence. Ensure you match the image with the waypoint and GPS position, recording on the survey recording form. Use the naming convention guidance (page 111) in the appendix for data and photo storage.
6) If completing the survey by snorkelling, use a safety marker buoy (SMB) and attach the GPS device in track mode to the SMB in a waterproof bag.
7) Once you have moved around the full circumference of the feature, stop the track mode on your GPS device.
8) For the mapped habitat, describe the main substrate, marine life cover and marine species present, recording on the habitat mapping recording form.
9) Make some notes to aid relocation of the habitat for future surveys.
10) Organise data and follow the data lifecycle – see data management section, page 93.

Have you read the getting started chapter?

Ensure you follow:

– Quality control guidelines, page 26
– Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

This survey can be undertaken at a spring low tide if the extent of the bed is exposed, allowing the survey to be undertaken by foot. If submerged, you can complete the survey snorkelling or in a kayak or small boat using a bathyscope.

Equipment

- Survey plan template, page 104 - *complete before the survey*
- Feature focus: habitat mapping recording form, page 137
- Hand-held GPS
- Suitable waterproof camera or video camera
- Identification guides
- Clipboards, pencils and waterproof protector or waterproof slate (for use in wet conditions or snorkelling)
- Tide tables
- First aid kit

In shallow water you may also require:

- Bathyscope: In shallow water, you may be able to survey wading or in a small kayak or boat with a bathyscope.
- Snorkelling equipment
  - Safety marker buoy (SMB) for surveyor
  - Waterproof bag or container for the GPS device (attach to the SMB for snorkelling)
  - **Follow snorkelling and wading safety tips within getting started,** page 11**.**

How to setup the survey

1. Plan survey location – *make use of satellite imagery*.
2. This survey can only be conducted with previous knowledge of a suitable habitat (such as a plant or animal bed or seaweed and kelp habitat).
3. Select a survey date
   - Choose a date with a low spring tide. This will expose the habitat out of the water and enable it to be surveyed by foot or allow it to be surveyed in shallow water snorkelling or in a kayak using a bathyscope.
4. Check weather and tides times for the planned survey location and time.
5. Prepare survey equipment.
6. Prepare GPS device (WGS84) – use the GPS device in track mode and ensure this is turned on for the duration of the survey. Ensure GPS is set to record in decimal degrees (e.g. 57.493723, -4.201847).
7. Arrive at the survey site at least 1.5 hours before low tide.
8. Fill out the survey and site information in feature focus: habitat mapping recording form.
9. Prepare survey plan using the survey plan template, page 104.

Tip: look at satellite imagery to help make your plan!

Survey method

1. Locate the feature you intend to map using a GPS device and maps from your survey plan. Spend some time looking at the feature to familiarise yourself with it.
2. Ensure your GPS device is recording your location in track mode.
3. Record the feature boundary. Locate the feature boundary and move around the boundary:
   - Take waypoints at intervals as you move around the feature boundary.
   - Take photographs or video footage at each waypoint of the boundary. *For intertidal, ensure the GPS screen is in the image/video where possible showing the correct time, date and GPS coordinate of the habitat you are mapping.*
   - At each waypoint, record the boundary description – *defined, patchy or gradual. You may need to explore past where you think the habitat boundary is to ensure is in not just the end of a patch.*
4. When you are confident you have surveyed the entire habitat in your survey area and reach the starting point again, stop mapping with the GPS device, switching off track mode on the GPS device.
5. Once mapping the boundary is complete, record the **time** and the **GPS position** (WGS84 in decimal degrees) of the habitat. Take a waypoint on your GPS device.
6. For the mapped habitat:

ⓘ Ensure your image, waypoint and boundary all match up on the survey recording form.

Describe the main seabed substrate.
Choose from:

- Rocky reef
- Boulders
- Cobbles and pebbles
- Sand and gravel
- Mud
- Mixed ground
- Other…

Describe the main seabed marine life cover.
Chose from:

- Kelp forest
- Kelp park
- Mixed seaweeds
- Encrusting pink algae
- Seagrass bed
- Maerl bed
- Tall animal turf
- Short animal turf
- Animal beds (please state what type .....)
  e.g. flame shells, blue mussels
- Sediment with life apparent
- Barren sediment
- Other… (please state .....)

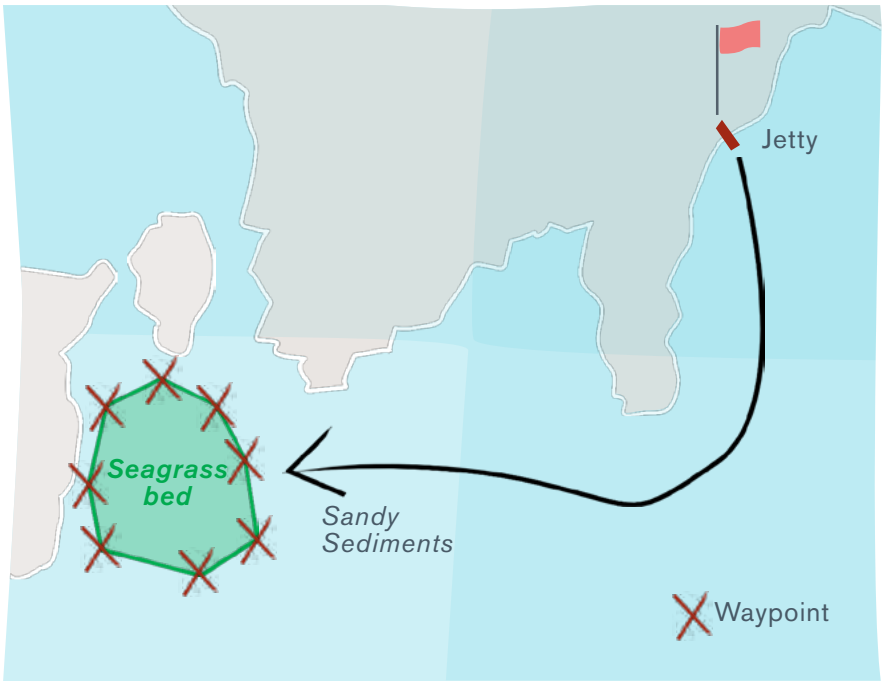
7. Describe the marine life species present.
    - *Try to identify all visible species indicating the most dominant species. Please provide an estimate of the number of each species over the survey area in terms of a known area (e.g. Queen scallop: 1 per 1m²). If unable to determine, indicate P for present.*
      This could include - seaweeds, sponges, starfish, brittlestars, feather stars, sea urchins, anemones, hydroids, sea slugs, bivalves, crabs, bryozoans, sea cucumbers, sea squirts, fishes.
8. Take some images or video footage that best shows the area and your observations. In particular, ensure the seabed marine life cover is visible in images.
9. Make some notes to help relocate the site – such as notable features, angles to headlines and viewpoints to help navigation.

Before you finish

1. Check all survey recording forms are completed fully.
2. Remove equipment from the site.
3. Wash equipment in freshwater, allow to dry, and store properly.
4. GPS device coordinate track file and waypoints should be downloading from the device and stored. You should refer to this after the survey to verify the correct GPS positions were recorded on your recording form.
5. Ensure all data (video files, recording sheets, GPS tracks etc.) are labelled appropriately using the correct naming convention and stored appropriately so the data can be accessed and used in the future. Use the naming convention guidance in the appendix (page 100) for data and photo storage.
6. Organise data and follow the data lifecycle – see data management section, page 93.

Create a map

After collecting survey data, it's possible to create a sketch map of the habitat area using the GPS track and waypoints.



▲ Example sketch map where the boundary of a seagrass bed was mapped.

3.4 Feature focus: habitat quality

DIFFICULTY LEVEL
ADVANCED

Introduction

In this survey you will focus on recording detailed information about the health of plant and animal beds. By surveying the density of a habitat-forming species we can gain important insight into the health of the feature.

This survey can be used to survey plant and animal beds that inhabit the intertidal zone when the features are exposed at low tide. This survey method follows Seagrass-Watch protocols but we have adapted it to include alternative steps for other types of plant and animal beds. We suggest using this method for seagrass beds and blue mussel beds.

▼ View of an extensive area of intertidal sediment flats with eelgrass (*Zostera noltei*) and casts of the lugworm.
© NatureScot

Survey briefing

Purpose

- Survey the health of plant and animal beds
- Determine percentage cover of the plant and animal bed
- Determine algae percentage cover

Additionally:

Seagrass beds -

- Identify percentage of epiphyte cover
- Determine the height of the canopy

Blue mussel beds -

- Determine the proportion of living mussels to shell debris

Overview

This should be undertaken on plant and animal beds that are found intertidally and cover an area larger than 50m by 50m.

1) Lay out three 50m transect line parallel to each other, 25m apart and perpendicular to the shore.
2) Record the GPS position at the start and end of each transect, recording the compass degrees looking down the transect towards the sea.
3) Place a quadrat every 5m moving down the transect.
4) Record data on the condition of the plant and animal beds. This will include recording data on % coverage, % algal coverage, identifying other marine life etc. within the 50cm x 50cm area.
5) Continue working in pairs until all quadrat stations are completed.
6) For seagrass you will need to measure the length of some shoots (minimum of three per quadrat).
7) Once completed, ensure all forms are completed fully.
8) Pack-up kit and rinse equipment.
9) Organise data and follow the data lifecycle – see data management section.

Have you read the getting started chapter?

Ensure you follow:

- Quality control guidelines, page 26
- Survey planning - common sense checklist, page 25

These can be printed and taken with you.

Setting up

Equipment

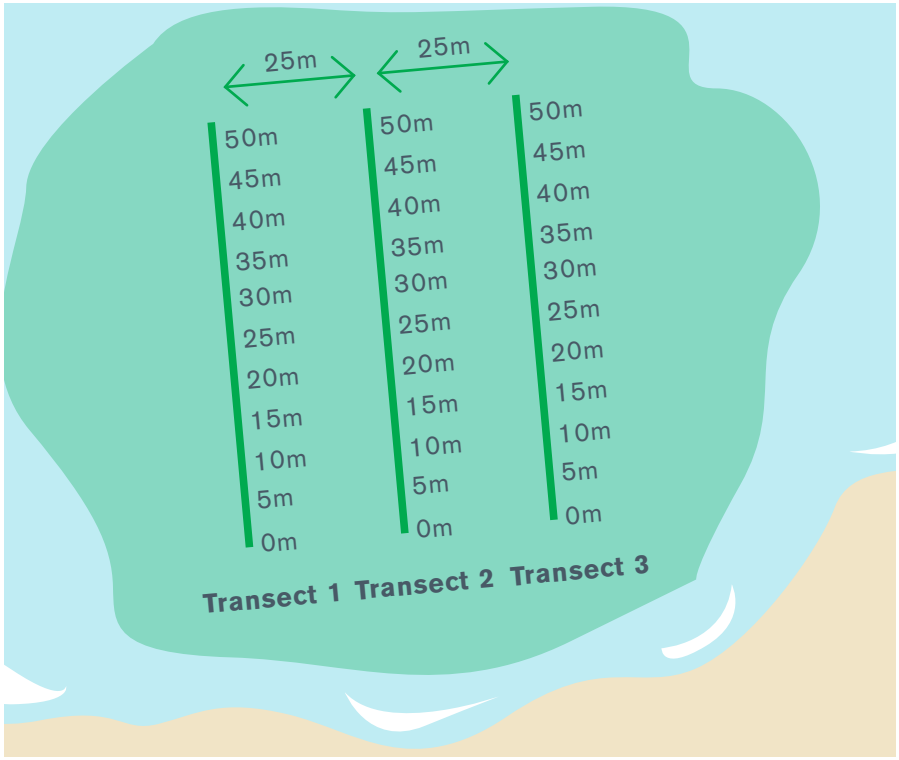
- Photo quadrat label template, page 110
- Feature focus: habitat quality recording form, page 139
- 50m transect line (x3 if three transects undertaken simultaneously)
- Hand-held GPS/ Smartphone (if GPS is inbuilt)
- Compass
- 50cm x 50cm quadrat (x3 if three transects undertaken simultaneously)
- Magnifying glass
- Clipboards, pencils, waterproof protector and 30cm ruler
- Camera/ smartphone
- Identification guides
- First aid kit
- Tide tables

How to setup the survey

1. Select a survey date –a low tide of 0.4m or less is recommended.
2. Check weather and tides for the survey location and time.
3. Arrive at the survey site at least 1.5 hours before low tide.
4. Fill out the survey and site information in the plant and animal bed recording form.
5. Lay out three 50m transect lines parallel to each other, 25m apart and perpendicular to the shore.

Record survey set-up

1. Record the latitude and longitude (WGS84 in decimal degrees) at the start and end of each transect, recording the compass bearing looking down the transect towards the sea.



◀ **Survey site setup. The green area represents a seagrass bed, detailing the positioning of the 50m transect lines and every 5m positioning of the quadrats.**

Survey method

Repeat these steps approximately every 5m distance gained in the plant or animal bed, you should complete 10 quadrats per transect line (within a site larger than 50m by 50m).

All habitats

Place a quadrat every 5m along the transect. Start at 5m on each transect. Complete one quadrat at a time working in pairs. For each quadrat:

1. Take a photograph of the quadrat – place a photo quadrat label beside the quadrat and the transect line (tape should be easily read with the correct distance in the photograph). Use the photo quadrat label template, page 110. Take the photo from directly above the quadrat, looking straight down, ensuring the image includes the entire quadrat frame, quadrat label and tape measure.
2. Describe the substrate composition – *e.g. cobbles and pebbles, sand and gravel, mud, mixed ground etc.*
3. Describe other features, identify and count any macrofauna – *such as bivalve, crabs, anemones.*
4. Identify the type of animal or plant bed (if present)- *e.g. seagrass, blue mussels.*
5. Estimate percentage cover of the bed.
6. Estimate algae percentage cover – *Make a note if the algae is overlying the habitat or rooted within the sediment. Note: this does not include any seagrass epiphyte cover.*

Additionally for seagrass

7. Estimate canopy height of the dominant seagrass species - *Measure from the sediment to the leaf tip of at least three shoots.*
8. *Estimate epiphyte percentage cover – epiphytes are algae or animals attached to seagrass blades and often give the blade a furry appearance. First estimate how much of the blade surface is covered, and then how many of the blades in the 50cm x 50cm quadrat area are covered (e.g., if 20% of the blades are each 50% covered by epiphytes, then quadrat epiphyte cover is 10%).*

Additionally for blue mussels

7. Record the percentage cover of live mussels.
8. Record the percentage cover of dead mussel shells.

Before you finish

1. Check all survey recording forms are completed fully.
2. Remove equipment from the site.
3. Wash equipment in freshwater, allow to dry, and store properly.
4. Ensure all data (images, recording forms etc.) are labelled appropriately using the correct naming convention and stored appropriately so the data can be accessed and used in the future. Use the naming convention guidance in the appendix (page 111) for data and photo storage.
5. Organise data and follow the data lifecycle – see data management section, page 93.

Polecam

A polecam is a video camera attached to a pole that can be deployed to record underwater. It can be customised to provide live stream of the camera footage to the surface and can be used in shallow waters or lowered on a rope to deeper marine habitats.

This is a simplified version of a drop down video system that is relatively cheap to create and effective to capture marine biodiversity data within coastal habitats. A polecam is a remote survey technique as it will allow survey participants to view the seabed or marine life underwater on an electronic screen (such as a tablet or mobile phone), allowing identification of the marine life to be made from the footage made.

Unfortunately, polecams cannot be purchased off the shelf – they require you to source the components and to build the system. However, it benefits from being much cheaper than a DDV system and you can customise the system setup to your requirements.

◄ **Blue rayed limpets (adult and juveniles) eating a kelp stipe in Loch Laxford.**
© Richard Shucksmith/NatureScot

▼ **Polecam prepared for surveying from a kayak.**
© Roger Cottis/South Skye Seas initiative

What you require

- An action video camera and robust underwater housing – we suggest a GoPro or SJCAM as these have apps that allow compatible live stream of the camera footage. Ensure camera and housing is depth rated to the planned deployment depth.
- Underwater light may be required.
- Underwater WiFi cable – this can be purchased online or you can research instructions to make your own.
- A pole to connect camera and lights to (and handlebar connectors) – This can be a long extendable pole for use on the surface or in shallow water (such as a swimming pool cleaning pole) or a short 1m pole that can be attached to rope for deep deployment (rope should be marked with length to estimate camera depth and the WiFi cable should be streamlined into the rope and/or pole).
- WiFi capable tablet or phone that is compatible with the action camera app.
- A waterproof cover for the tablet or phone.
- A tablet shade or hood maybe required to prevent glare from the sun – sun on the tablet can make it very difficult to see the screen.
- Tape or glue to connect WiFi cable to the camera and tablet/phone.

Operation

To use the polecam at shallow water depth (<5m), we suggest you use the camera on a long extendable pole.

To use the polecam at deeper water depths (>5m), we suggest you use the camera on a short pole attached to a rope for deployment. The polecam will move along the seabed by drifting with the deployment vessel, recording the seabed as it moves along. The depth of use will be limited to the camera housing depth rating and the length of WiFi cable used.

A GPS position can be generated by a hand-held GPS device or a GPS compatible tablet/ smartphone. The depth of the camera can be estimated by knowing the length of pole and/or rope deployed.

Operating a polecam for marine survey work can be completed by one person, however we recommend a crew of three people. The roles to be covered include:

1. Operation – deploy the polecam and manage its depth (compulsory).
2. Marine life and seabed observer – fill in recording form.
3. Supervisor and data quality assurance – oversee survey and have attention to safety and logistics, maintain good data collection and applied methodology

Deployment

- A polecam can be deployed from the shore in shallow waters, from a kayak or a boat.
- The polecam should be carefully lowered into the water, keeping the camera away from any hard or sharp objects.
- Deployment from a boat - keep the polecam clear of the boat's propellers or jets and make sure that the captain of the boat knows when the polecam is about to be deployed.

Drop down video system

A drop down video system (DDV) is a marine survey equipment setup that is typically an underwater camera and lights on a robust sled/frame. DDV systems generally have a live stream of footage to the surface, built in depth sensors and lasers to provide a scale to estimate the field of view.

DDV systems are the preferred surveying technique for marine benthic habitats and are used as standard by professionals.

A DDV system is similar to the polecam in the same way that it can be deployed to the seabed as a remote survey technique. To allow survey participants to view the seabed or marine life underwater, an electronic screen (such as a laptop or tablet) should be connected to allow identification of the marine life to be made from the footage. However, a DDV system is more specialised, often with a GPS location and time stamp overlay on all footage recorded. The depth of use will be limited to the DDV manufacturer specifications. The system designed to be robust and has a frame to allow the system to be landed on the seabed to capture static video stills. DDV systems sometimes have a surface power supply that will power all electronics (such as the camera, lights, lasers) enabling you to survey for a long period without battery restrictions.

To purchase a DDV system, you will need to go to specialised underwater survey equipment supplier. They can advise on a DDV system setup based on your requirements and budget.

A GPS position can be generated by a hand-held GPS device or a GPS compatible tablet/ smartphone. The depth of the camera can be recorded accurately by notching the length of pole and/or rope deployed.

Operation

The DDV will move along the seabed by drifting with the deployment vessel, recording the seabed as it moves along.

A GPS position can be generated by connecting a GPS to the surface device (e.g laptop) which can be stamped on the video footage or by using a hand-held GPS device. The depth of the camera can usually be recorded from inbuilt depth sensors.

Operating a DDV for marine survey work will usually require a minimum crew of three people. The roles that typically need to be covered include:

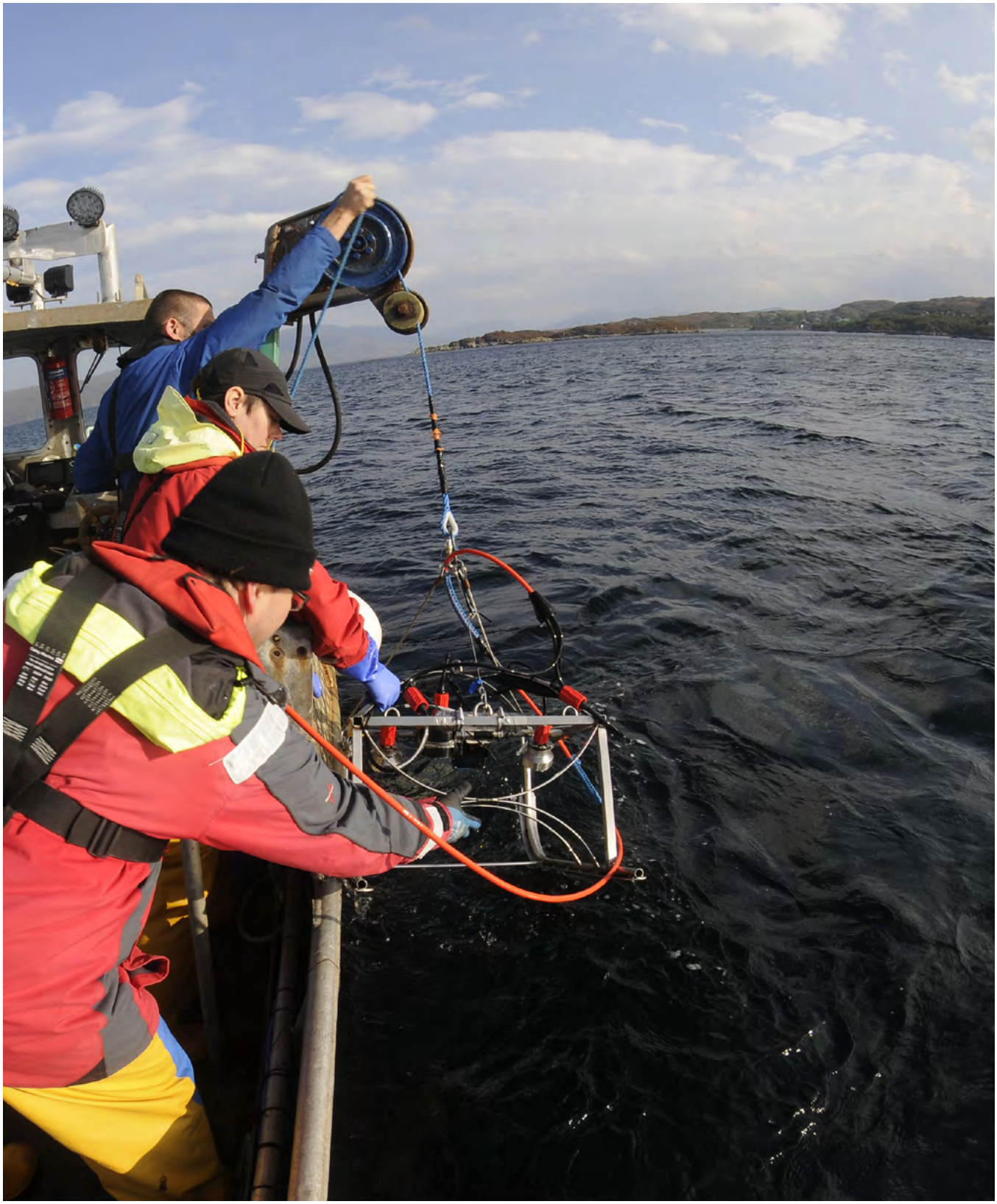
1. Operation – deploy the DDV and manage its depth (compulsory).
2. Tether crew – maintain good tether management (compulsory).
3. Marine life and seabed observer – fill in recording form (compulsory).
4. Supervisor and data quality assurance – oversee survey and have attention to safety and logistics, maintain good data collection and applied methodology.

Deployment

- A DDV will need to be deployed from a boat. They typically require a deployment rope to avoid the tether taking the weight of the DDV system.
- The DDV should be carefully lowered into the water, keeping the camera away from any hard or sharp objects.
- Deployment from a boat - keep the DDV and tether clear of the boat's propellers or jets and make sure that the captain of the boat knows when the DDV is about to be deployed.

▼ **A drop down video system deployed from a boat.**

© Ben James/NatureScot



Remotely operated vehicle

A remotely operated vehicle (ROV) can be used to survey the seabed. They benefit from an increased manoeuvrability in the water compared to drop down video systems.

Operation

Operating an ROV for marine survey work will usually require a minimum crew of three people. The roles that typically need to be covered include:

1. Pilot – drive the ROV (compulsory).
2. Tether crew – maintain good tether management (compulsory).
3. Marine life and seabed observer – fill in recording form (compulsory).
4. Supervisor and data quality assurance – oversee survey and have attention to safety and logistics, maintain good data collection and applied methodology.

Tether management

Guidelines for good tether management:

- Keep the tether away from propellers or jets if you are operating on a boat.
- Keep the ROV away from boats that do not know that the ROV is in the water.
- Keep the tether away from sharp objects such as coral, rocks, etc.
- Do not deploy too much tether. Excess tether in the water will add drag to the ROV and increase the opportunity for the tether to get caught.
- Do not deploy the tether over sharp edges or rough ground.
- Do not step on the tether.

Deployment

- Keep lights switched off until the ROV is in the water.
- Do not launch the ROV near swimmers or divers.
- The ROV should be carefully lowered into the water, keeping the camera dome away from any hard or sharp objects. Do not drop the ROV into the water. If necessary, use a rope to lower it down.
- Do not launch in water that is too shallow to freely drive the ROV.
- Do not start the ROV propellers until it is in the water and the ROV is clear of obstructions and crew.

Shore deployment:

- Do not launch the ROV in heavy surf.
- You may need to walk the ROV into the water to get to a point where the water is deep enough to drive the ROV (you will require a wetsuit or drysuit).

Boat deployment:

- Keep the ROV and tether clear of the boat's propellers or jets.
- Make sure that the captain of the boat knows when the ROV is about to be launched.

Pilot guidance

- Pilot smoothly and on low speed when possible to maximize battery life.
- Do not pilot into a sandy bottom. If you do pilot into a sandy bottom, stop the ROV and allow it to float up to prevent sand from getting into the vertical thrusters.
- Avoid driving into seaweed and do not use an ROV to survey close to kelp beds or forests. Seaweed can get sucked into and stop the thrusters from spinning. In Scotland, Sea lace or Mermaid's tresses (*Chorda filum*) can be abundant in shallow water in summer and can be a problem if caught in ROV propellers. This seaweed has unbranched cord-like fronds and can grow to 8m long.
- Use a visual reference on descent and ascent to help the pilot navigate – such as a weighted line or anchor.

ROV direction in the water

An ROV will move through the water under the control of the pilot. However, tidal movement will also change the ROV's bearing. Tidal movement can change underwater as a result of underwater features and can have a large effect on the ROV movement.

If using the ROV to complete an underwater video transect survey (not recommended unless in optimal conditions), you should take a compass bearing from the static deployment boat to the ROV. To do this, the ROV should be brought to the surface at the end of the video transect, taking a heading at this point. If you suspect the ROV did not travel in a straight line transect, please record survey data using the underwater marine life observation survey methods.

▼ **Shore deployment of an ROV from a beach in Skye.**

© Roger Cottis/South Skye Seas initiative

Dive Mode			
	Manual	**Maintain a Heading**	**Depth Hold**
Description	In manual mode the ROV pilot has full control over manoeuvring the ROV in the water. This gives the pilot control to move around the seabed both vertically and horizontally, and will require a skilled pilot. This mode is best used if you want to fully explore the seabed without being stuck to the limits of moving in a straight line. Using an underwater GPS or estimating GPS coordinates for features will provide a georeferenced image to document your marine life findings.	Many versions of ROV's have built-in dive modes that can be used to maintain a set course - sometimes called a 'stabilisation mode'. The pilot can still manoeuvre the ROV vertically in the water column, allowing the pilot to maintain an appropriate distance from the seabed however, the ROV will maintain a set heading unless commanded to turn. This mode is particularly useful when manoeuvring over a seabed that is increasing or decreasing in depth.	It can be useful to survey along underwater depth contours when surveying as it's likely that the seabed is exposed to the same environmental conditions which can create a similar habitat and species composition. On seawalls and underwater drop-offs the seabed depth can decrease rapidly. Using a depth hold mode will make it easier to control the ROV. For surveying a seawall, it is useful to gain data on marine life that occurs at a fixed depth band (i.e. survey the seawall at increments in depth band, such as 10m, 20m, and 30m).
When to use	Exploring a seabed with underwater navigation features (such as a bay, headland, ridge or mooring). **Underwater marine life observation survey** – To record what you see, follow the marine life observation survey methodology.	Exploring an unknown area or an area of seabed without distinguishable features to assist navigation. **Underwater video transects survey** – Completing survey video transects should maintain a set direction throughout the transect recording. Please refer to considerations for ROV direction in the water above.	Surveying a steep seawall or areas of seabed with a rapid depth drop.

ROV GPS Positional Data

Underwater GPS system

GPS signals from satellites do not penetrate underwater. However, it is possible to collect this information using a 'wet-connect GPS' system that can calculate an ROV's position underwater.

The ideal set-up would be for the ROV to have positional GPS data overlay while underwater to provide detail on the ROV's exact position underwater. A coordinate file showing the ROV track should be stored for each survey. However, an ROV underwater wet-connect GPS systems is a specialised piece of equipment and are generally expensive to fit.

ROV estimated GPS calculation

It is possible to estimate GPS using a calculation taking into account ROV depth, compass bearing to the ROV and the length of tether deployed.

Using the depth of the ROV, length of tether and the ROV heading from the deployment boat, trigonometry can be used to estimate the location of the ROV.

To minimise error in the estimation, slack and curvature in the tether should be minimised when recording tether length. Where possible, the ROV should be used in a mode to maintain a constant heading to reduce GPS positional error.

Important! A GPS estimate will not be 100% accurate.

Requirements:

1. GPS fix of the deployment site (such as vessel or shore) –**in decimal degrees (DD)**
2. ROV depth
3. Length of tether deployed
4. Compass bearing from the deployment site (such as vessel or shore) to the ROV

Image quality

The key to image quality

For using polecam, drop down video (DDV) systems and remotely operated vehicles (ROV).

Technology –

1. **Camera quality**

   We recommend using a good quality camera with good video resolution. Using cameras underwater will require a robust underwater housing that can withstand a degree of knocks and salt water.

2. **Resolution of video**

   For best quality, cameras that can record HD (1080 x 1920) resolution and 30fps is sufficient. Using 60fps will provide additional quality for video frame stills from the footage.

3. **Lighting**

   Colour (especially red) is not visible using only natural light underwater, so underwater lights are required to get a clear image of the seabed. Lights should be wide angle to provide even lighting across the whole frame (avoid focussed spot lights).

4. **Camera angle**

   For most purposes it is best if the camera is pointed forward at about 45 degrees– about half-way between straight down and straight forward. Pointing the camera straight down would make the image appear to move very quickly and everything would look 'flat' (without depth), whereas pointing directly forward would mean insufficient detail of the seabed would be visible.

Technique – The way in which the camera or ROV is moved is of critical importance to be able to identify species and habitats. Techniques include:

1. **Height above seabed**

   Generally the closer the camera to the seabed the better the video quality. However, it is recommended to maintain the camera at 30cm-1m off the seabed for optimum image quality. It is also useful to vary the distance at times, and to record the camera lifting off the seabed at the end, because images from higher up can be used to see the wider habitat.

2. **Slow speed**

   The camera should move at a very slow pace, the slower the better! This should be below 1 knot, preferably 0.6 knot or lower. At faster speeds the image will be very blurred and make identification difficult.

3. **Regular stops**

   Regularly landing on the seabed for 2 to 3 seconds will provide static close-ups of the seabed substrate and species. Using this is particularly important if the camera speed is relatively high.

GPS device

A global positioning system (GPS) is used to figure out exactly where you are on the surface of the earth. It works by receivers (such as mobile phones or GPS devices) calculating the distance to three or more satellites to accurately determine your position.

How will a GPS device help me survey the sea?

A GPS device will enable you to:

- Determine the location of marine features.
- Determine the size of habitats.
- Map habitat and species distribution.
- Revisit a marine feature for monitoring.

What devices can I use to determine my GPS location?

- Most smartphones have built in GPS capability.
- Purpose built hand-held GPS devices.
- Boats will have a GPS device on board.
- For using a drop down video system (DDV), a plug in GPS receiver can be connected to the surface control computer.
- Remotely Operated Vehicles (ROVs) can be fitted with a special underwater GPS system.

For operation instructions, please refer to the user manual of the GPS device.

Coordinate system and map datum

Coordinates are specific to the map datum used. Datum's may be global, meaning they represent the whole earth or local, representing a specific orientation by ellipsoid best fit to an area of earth. The global datum that is most widely used is the World Geodetic System (**WGS84**) – this is the same datum as Google Earth.

The recommended setting for your GPS device or mapping software is WGS84.

The coordinate system used is **latitude and longitude**. The latitude (abbreviation: **Lat**) is the horizontal map coordinate (how far North or South you are) while the longitude (abbreviation: **Long**) is the vertical map coordinate (how far East or West you are). Latitude and Longitude coordinate can be expressed in different formats. All are equally valid and it is also possible to convert coordinates between formats but we recommend you stick to consistently using the same format.

It is recommended to use decimal degrees.

(Example: 57.493723, -4.201847)

This is because decimal degrees is the accepted format for marine data. If it is logistically easier to record in another format, then this must be converted into decimal degrees and filled in on the survey form. You will find a conversion tool easily online.

The MEDIN marine data standard requires all GPS data in the format of WGS84 and decimal degrees. This is to ensure a standardised framework for all marine data, making marine surveys results easier to use and compare findings. If you record the GPS position in any other coordinate system (such as National Grid Reference (NGR)), then this **must** be converted into WGS84 in decimal degrees.

You must state if you have converted the coordinate system from any other format (NGR) to WGS84, providing details.

The same latitude and longitude coordinates in different formats:

Decimal Degrees (DD): (our preferred format)

57.493723, -4.201847

Degrees and Decimal Minutes (DDM):

57°29.6234'N 4°12.1108'W

Degrees, Minutes and Seconds (DMS):

57°29'37.4"N 4°12'06.7"W

GPS for habitat mapping

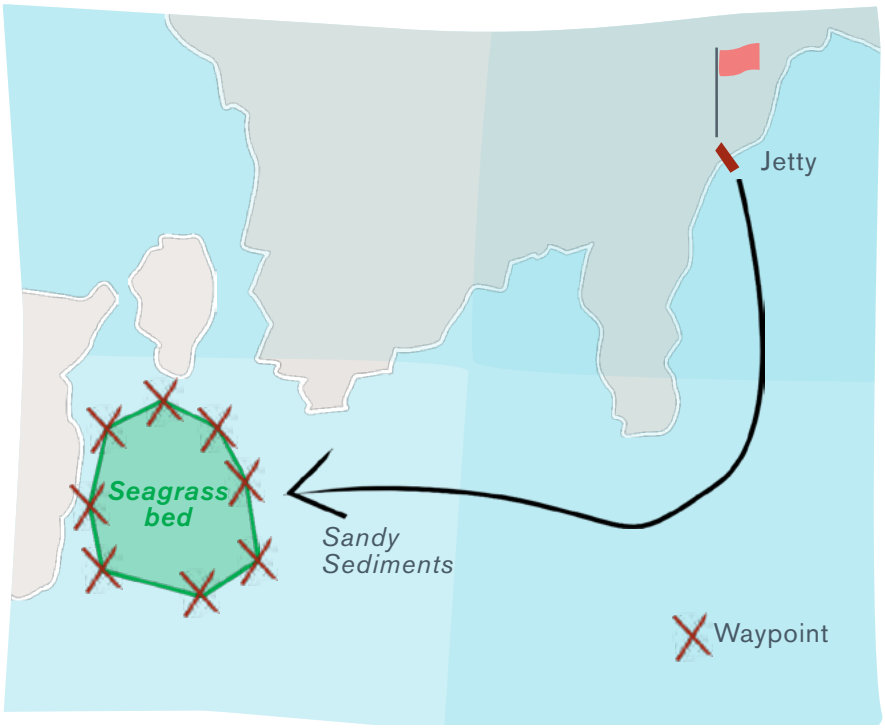
GPS tracking

GPS can be used while surveying on a boat to track the movements of the vessel for the survey. It can also be used to track individual survey station transect locations along the full route. The tracks can be displayed against a map backdrop using mapping software or Geographic Information Systems (GIS). Tracking software may also available for smartphones with GPS capability. There is often a set mode that can be turned-on on a GPS device.

Waypoints

When surveying, positions (such as survey stations and features) can be stored as waypoints. This is often a one-click button on a GPS device. You can assign a name to the waypoint when storing the position.

It is recommended to give waypoints consistent names that indicate what they represent and record these in the survey recording forms.



▲ **Example sketch map where the boundary of a seagrass bed is mapped.**

Permanent monitoring stations

To measure changes over time, you can either sample the same part of a site in a permanent monitoring station, or you can survey a wider area using a randomly selected set of survey points. When you survey using a permanent monitoring station, the difference in the results can be linked to environmental and/or community interaction change, while random sampling is more complicated. When using random sampling, the difference in results will often require the use of statistics for comparisons whereas permanent monitoring stations have a smaller reliance on statistics to detect a trend.

Community long-term monitoring

Permanent monitoring stations offer the greatest amount of information, consistency, repeatability and reliability.

Permanent monitoring stations should be selected using a random selection process within your target habitat to ensure they are truly representative – objective not subjective.

Marking stations

Permanent monitoring stations can be marked so that the transect line, quadrats or photographic equipment can be placed as close as possible to the same position on each visit. There are different techniques that can be used to mark stations; this can include marking bare bedrock with paint or hammering stainless steel stakes, rod or star pickets into the substrate. Using stakes, rods or pickets will provide something for your transect line to attached to and follow to ensure the transect line is in the exact same position as previous visits.

Finding permanent monitoring stations

1. Sketch maps of the area with the stations marked on with reference to features, compass bearing and line of sight with the surrounding area.
2. Using a GPS device to relocate the stations using the Latitude and Longitude coordinates from previous visits. Please ensure you use the same datum, such as WGS84.
3. Station markings – such as paint, rods, stakes or star pickets.

Advantages:

- Once set up, repeat monitoring is easy
- Easier to detect trends in the data to interpret results

Limitations:

- Can be time consuming and expensive to set up
- Unless clearly marked it can be difficult to find stations and waste survey time

Note: Some of the change detected in your results may be a result of human error, this should be acknowledged. However, the impact of human error can be minimised by complying with the quality control guidelines within the getting started chapter, page 26.

Priority marine features

This section details information about the inshore priority marine feature (PMF) seabed habitats, many of which are features characteristic of the Scottish marine environment.

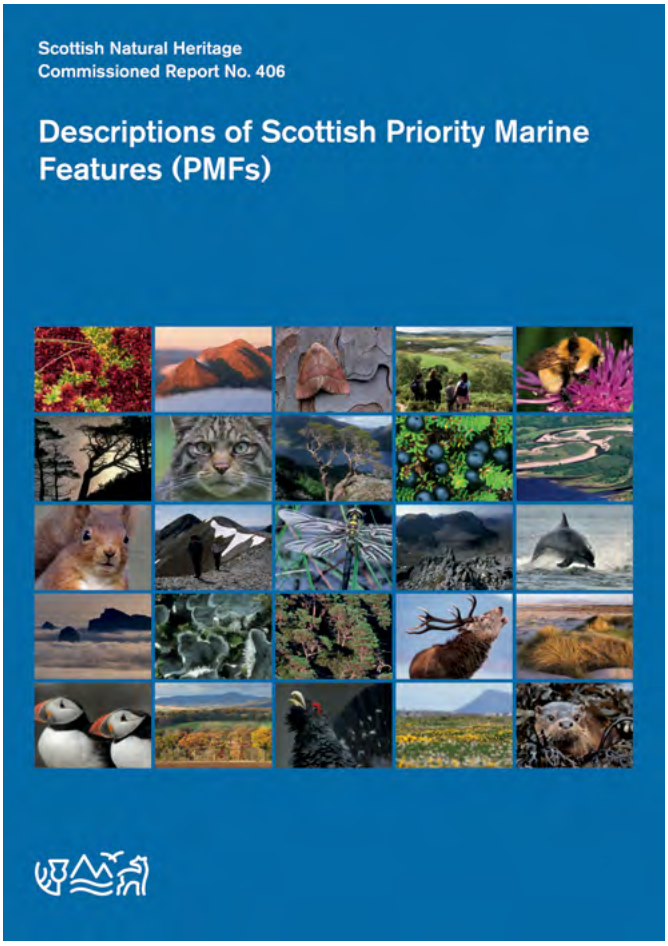
A list of PMF species and habitats of conservation importance were identified based on criteria that considered:

1. Whether the species/habitat occurs in significant numbers in Scotland's seas
2. Whether the species/habitat is under threat or in decline
3. The functional role that the species/habitat plays

We recommend that your marine survey or monitoring project should highlight the presence of seabed and intertidal habitats and species. Knowledge of where PMFs and other habitats and species are found can help marine conservation and planning and direct future research and education.

We have summarised information on some of the seabed habitat PMFs in the following sections. The images of the PMFs are close-ups of the characterising features of each PMF. Note that there are working definitions of PMFs that indicate for some features an area of 5m x 5m with specific densities are required to qualify as a 'bed'.

Only identify marine life within your knowledge and skills, don't feel pressured into identifying species and habitats if you are uncertain.



For more information on all 81 PMFs, including biotope details and mobile species please see the full descriptions within the Scottish Natural Heritage Commissioned Report No.406 Descriptions of Scottish Priority Marine Features (PMFs).

Visit https://www.nature.scot/snh-commissioned-report-406-descriptions-scottish-priority-marine-features-pmfs

More information about some PMFs, including the PMF definitions can be found within the Priority Marine Feature Review documents.

Visit https://consult.gov.scot/marine-scotland/priority-marine-features/

◄ A flame shell on a bed with red seaweeds and kelp in Loch Carron. Flame shell bed habitat 'identifiers' can be seen such as empty white flame shells on the surface and gallery openings.

© Rob Cook/NatureScot

Seabed habitat priority marine features


© Lorne Gill/NatureScot

Blue mussel beds (*Mytilus edulis*)

Description

Blue mussels can form beds or reefs in the intertidal or subtidal. The beds stabilise sediment and create a habitat for a diverse community of animals and plants.

Environment

A variety of rock and sediment types in the intertidal and subtidal (0- 30m), and in a range of conditions from open coasts to estuaries and marine inlets.


© Graham Saunders/Marine Scotland

Burrowed mud

Description

Areas of fine sediments that are home to a range of burrowing crustaceans, including langoustine, mud shrimps, and crabs. Burrows and mounds are a prominent feature of this habitat. Look out for seapens, firework anemones and the conical mounds built up by mud volcano worms.

Environment

Areas of fine mud, and muddy sand in water depths ranging from 10m to greater than 500m. The habitat is found in sea lochs and voes and in full or variable salinities.


© Graham Saunders/Marine Scotland

Flame shell beds *(Limaria hians)*

Description

Flame shells create nests by binding together e.g. pieces of gravel, shell, seaweed or maerl, and where conditions allow carpet the sea bed for several hectares. The carpets create a habitat for many organisms including hydroids, bryozoans, ascidians and seaweeds and provide shelter for other species such as juvenile cod and saithe, scallops and crabs.

Environment

Occurs on mixed muddy, sandy and gravelly bottoms in sheltered areas of moderate to strong currents, usually at depths of 5-30m but occasionally deeper. They are often found in tide-swept narrows such as the entrances or sills of sea lochs.


© Graham Saunders/Marine Scotland

Horse mussel beds (*Modiolus modiolus*)

Description

Horse mussels can occur in scattered clumps, thin layers or dense raised beds, which can extend up to several hectares in size. The beds increase local biodiversity, stabilise the sediment and may provide settling grounds for commercially important bivalves, such as scallops.

Environment

Weak to strong water movement on a variety of mixed substrata. Found at depths of 5-220m, though most known beds are between 20-50m.


© Richard Shucksmith/NatureScot

Kelp beds

Description

Beds of the kelp *Laminaria hyperborea* form as forests and parks in rocky coastal areas, under a variety of wave and tidal conditions. The kelp provides a canopy under which a wide range of animals and other seaweeds thrive.

Environment

Kelp beds occur in shallow waters (to a maximum of 20-30m), on bedrock and boulders in a range of wave exposure regimes and tidal conditions.


© Lisa Kamphausen/NatureScot

Maerl beds

Description

Maerl beds are formed by a red seaweed with a hard chalky skeleton that grows as small rounded nodules or short branched twig-like shapes. In high abundance, maerl can form interlocking beds, supporting communities of plants and animals such as seaweeds, sea urchins, brittlestars, starfish, sea anemones and scallops.

Environment

Coarse clean sands and gravels either on the open coast or in tide-swept channels to a depth of about 30m. Occasional records from muddier sediments e.g. Loch Torridon.


© David Donnan/NatureScot

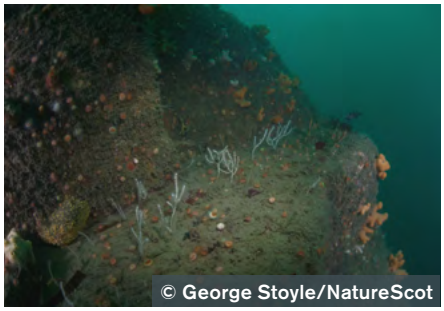
European Native oysters (*Ostrea edulis*)

Description

This once widespread habitat comprises dense beds of the native oyster *Ostrea edulis* (at densities of five or more per m²). A diverse community lives on, amongst, or in the sediment beneath the bed.

Environment

Associated with productive estuarine and shallow coastal water habitats on firm mud, muddy sand and muddy gravel with shells and stones. Sheltered coasts from the intertidal to 5m and occasionally to 20m.


© George Stoyle/NatureScot

Northern sea fan and sponge communities

Description

A diverse habitat characterised by aggregations of the northern sea fan *Swiftia pallida* and the cup coral *Caryophyllia smithii* on upper and vertical surfaces of bedrock and boulders (20-50m). With increasing water depth (35-120m+), and in areas of low tidal flow, erect branching sponges replace sea fans as the most striking component of the habitat.

Environment

Found on circalittoral bedrock and boulders on silty sediment, in wave-exposed to wave sheltered areas and in fully marine conditions at depths of 20-120m+.


© Ben James/NatureScot

Seagrass beds

Description

Seagrasses are marine flowering plants found in shallow coastal areas, typically on sheltered sandy or muddy substrata. Seagrasses often grow in dense, extensive beds or meadows, stabilising the sediment and creating productive habitats that provide shelter and food for a wide variety of plants and animals.

Environment

The seagrasses grow in sands and muds from the upper shore down to 10m, in areas at least moderately sheltered from wave action such as sea lochs, inlets, bays, sounds, channels and lagoons.


© Tom Mercer/NatureScot

Sea loch egg wrack beds (*Ascophyllum nodosum*)

Description

A detached dwarf variety of common egg wrack. Individual plants rarely exceed 60cm in diameter but they often grow together to form dense mats. Occurs as two forms - the 'beach' form is olive green or yellow, very branched, and may appear bent and irregularly twisted; whereas the smaller 'turf' form is found on the upper shore as individual plants where it forms small clumps or mats.

Environment

Found only in very sheltered conditions such as at the heads of sea lochs, on the mid to lower reaches of gently sloping shores where it sometimes grows with other brown seaweeds.


© Sue Scott/NatureScot

Serpulid aggregations (*Serpula vermicularis*)

Description

Dense clumps or reefs of white chalky tubes, each containing a *Serpula vermicularis* worm. These aggregations can reach over 1m in height and 2m width, with individual tubes up to 5mm wide and 15cm in length. Serpulid aggregations provide solid substrata in an otherwise sedimentary area. The species is common as individuals but well developed reefs are only known from one location in Scotland (Loch Creran) and very few worldwide.

Environment

Sheltered to extremely sheltered sea lochs or inlets with weak or very weak water flow, at depths of 6-10m.

Non-native species

What are non-native species?

Non-native species are plants and animals that live outside their native range. With the increase in global travel and movement of goods by ships, more species are being moved around and can be introduced accidentally or deliberately outside their native range.

Non-native species can become a problem if they become 'invasive non-native species' by outgrowing, killing or outcompeting local species. Invasive non-native species can cause damage to local habitats and impact on the food chain and biodiversity. It can also lead to financial costs for marine industries including fisheries, aquaculture and the broader leisure and commercial marine sectors.

How can I help?

1. **Document their abundance and distribution**
   You can help us learn more about their current abundance and distribution within Scotland and your local area by searching for them and recording their location. This can be done by submitting species observations with images to iRecord.
   - Please follow the species image library survey method, page 29.
   - Additionally, note roughly how many you saw in the description.
2. **Avoid spreading non-native species**
   Thoroughly wash all kit following Check Clean Dry biosecurity principles. See getting started, impact on the environment, page 15 for details.
3. **Do not remove the suspected non-native species**
   They may look similar to our native plants and animals and moving them may risk spreading the species.
4. **Share your findings**
   Ensure any local authorities or national recording schemes for non-native species are aware of any findings in your area.

Further biosecurity information and guidance for boaters and paddlers can be found on GB Non Native Species Secretariat (NNSS) - www.nonnativespecies.org/checkcleandry/.

Non-native species key

Carpet sea squirt (*Didemnum vexillum*)

American oyster drill (*Urosalpinx cinerea*)

Pacific oyster (*Magallana gigas*)

Japanese kelp, Wakame (*Undaria pinnatifida*)

Trumpet tubeworm (*Ficopomatus enigmaticus*)

Orange ripple bryozoan (*Schizoporella japonica*)

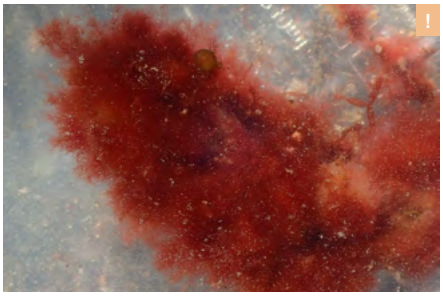
Leathery sea squirt (*Styela clava*)

Compass sea squirt (*Asterocarpa humilis*)

Orange-striped sea anemone (*Diadumene lineata*)

Chinese mitten crab (*Eriocheir sinensis*)

Japanese skeleton shrimp (*Caprella mutica*)



A red seaweed (*Bonnemaisonia hamifera*)

Slipper limpet (*Crepidula fornicate*)

Wireweed (*Sargassum muticum*)

!!! = High impact – already found within Scotland

!! = High impact – already in the UK, but not yet recorded or verified in Scotland

! = Mid, low or unknown impact – already found within Scotland

Image acknowledgements for non-native species ©David Fenwick at aphotomarine.com, unless otherwise stated. Visit www.aphotomarine.com for more information.

Data management

Good data management is as important as good data collection. Following good data management guidelines will ensure the data you collect today will be useful in the future. Your survey findings risk being lost or a challenge to access or use if data is not managed properly.

Data management recommendations

1. Ensure quality control guidelines are in place (see getting started - quality control, page 26).
2. When possible use waterproof paper or a waterproof recording slate in the field to collect data.
3. Survey recording forms must be fully completed. This should be checked before finishing a survey.
4. Recording forms completed in the field should be retained for filing – or recorded onto a clean recording form where necessary (hard copies should be kept of all data sheets).
5. Survey recording forms should be entered into a spreadsheet at the end of each day.
6. Data entry should be checked by a second person to minimise transcribing errors.
7. Electronic copies should be stored in relevant (survey type or location) folders. Use the naming convention guidance in the appendix for data and photo storage.
8. Back-up copies of all electronic data should be made.

Data ownership

Data ownership and data sharing permissions should be agreed and documented at the time of the survey and/or at the time of organising data. We suggest that sharing and re-use be permitted under the terms of a Creative Commons Attribution Licence: CC BY (https://creativecommons.org/licenses/by/4.0/). We have provided space to record the data owner on the survey recording forms, ensure this is completed; the data owner is likely to be the community group organising the survey.

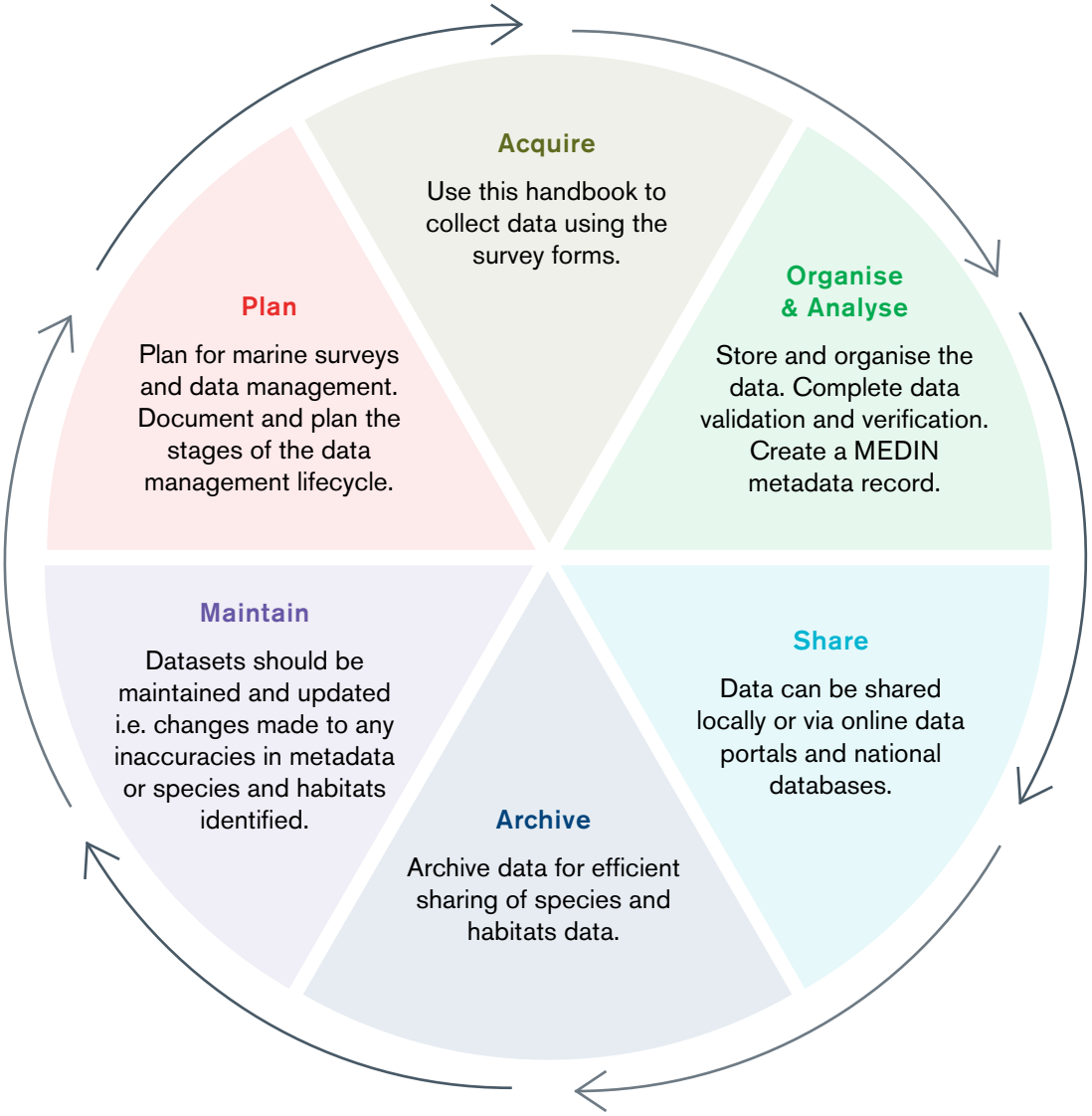
◄ Velvet swimming crab on a carpet of pink jewel anemones and red seaweeds at Dun Arch, St Kilda.

© Richard Shucksmith/NatureScot

How to manage your survey data

As part of the community-led marine biodiversity monitoring project, NatureScot are working with community groups to find opportunities and solutions to allow data collected using the handbook to flow into national data portals, following the data lifecycle steps. Following the guidance on collecting and recording data within this handbook will help with establishing a data flow. After a pilot has been undertaken and a data flow established, we will provide an update and further guidance. In the interim, we have provided some information on citizen science portals, websites to share data and the appropriate data archiving centre (DAC) that are available. Ensure you check the copyright permissions and privacy policies of all portals, websites and DACs before use. Please note that you should only submit records via one data storage or sharing website/app/portal to avoid duplication of records.

Data lifecycle



▲ **The data lifecycle illustrates the elements of data management. This will improve the overall quality of your data and should be used for all community-led survey projects.**

Quality assurance

The quality of the data you collect will be influenced by the survey design. You should follow the guidance within this handbook and follow the methods and survey forms fully to maximise the quality of your data. It's important that the quality of the data is known as it will be more scientifically useful and more likely to be used as evidence by policy makers.

There are two steps you can take to help increase the accuracy and overall quality of your data:

Validation

- This is the process of checking all survey data is complete and that the data satisfies set formats or values (e.g. checking the data is organised correctly with all data required - who collected the data, dates, times, GPS coordinates, etc.). Please see the 'Metadata – the data behind the data' poster on page 98.
- You should create a Marine Environmental Data and Information Network (MEDIN) Discovery Metadata record (see MEDIN compliance below). This is an automated process to help validate your data using the MEDIN Discovery Metadata Editor.

Verification

- This is a manual process where you check the species and/or habitat identification is correct. For example, you can check the marine species or habitat information by visually checking videos or photographs associated with the data. Verification can also be undertaken by accompanying a few participants and observing the measurements that they take or crowd sourced by asking people to assess each other's photographs or asking different people to take measurements at the same time. Sometimes it may be necessary to contact experts, to determine species or habitats identification. Don't be afraid to flag a record as uncertain.
- It is important to keep a record of species and/or habitat assignment history (sometimes referred to as taxon determination history). Practically this means you should keep a record of who assigned what species or habitat identification and when. This is important to track and maintain the quality of the data.
- The survey methods have been designed to ensure that photographic or video evidence is captured which will allow verification to be completed.

  Available citizen science portals for verification - *can be used for species records recorded in the species image library survey method.*

  #### iSpot

  iSpot is a website aimed at helping anyone identify anything in nature. Users can upload their observations of wildlife, help each other identify it, and share and discuss what they've seen. Records submitted to iSpot will be made available through the NBN Atlas once verified.

  Visit www.ispotnature.org.

  #### iRecord

  iRecord is a UK based website for sharing wildlife observations, storing biodiversity records and getting them reviewed by experts for species identification. You can also explore maps and reports of your data. The data can also be shared via the platform to other data repositories, such as NBN Atlas.

  Visit www.brc.ac.uk/irecord.

Taxon dictionaries

A taxon dictionary is a register of names of organisms that are taxonomically correct, controlled and kept up to date by experts who are responsible for controlling the quality of the information. In practical terms, this means a list of species names that are correctly accepted and deemed correct, their common names (if any), their classification within the taxonomic hierarchy and the background such as the original description (e.g. common starfish – *Asterias rubens* Linnaeus, 1758).

Marine Dictionaries to use for Scotland:

- **Marine Species of the British Isles and Adjacent Seas (MSBIAS)**

  This is a regional subregister of World Register of Marine Species (WoRMS) for marine species around the UK. This taxon dictionary is specifically used for Scottish and UK national databases. When identifying marine species or verifying records, you should use MSBIAS. This is the accepted taxon dictionary to ensure your data meets MEDIN compliance for marine data standards (see below).

  Visit http://www.marinespecies.org/msbias/

Marine habitat classification

The classification lists all seafloor habitats currently known to occur in UK waters. These habitats are organised in a hierarchy whereby each level introduces more detail. In any place on the shore or seabed, a suite of species will occur, each adapted to the particular environmental conditions of that place. Where such a suite of species occurs in other locations under similar environmental conditions, it can be defined as a community (or association or assemblage) of species which is occurring within a particular habitat type. The collective term biotope is now in common usage to encompass both biodiversity and environmental elements.

The classification is widely used by Government bodies, academic institutions, the private and charity sectors as a system for the consistent description of habitat types. If you wish to assign a habitat identification to a survey record, the biotope system should be used, however you should only assign classification to the appropriate level within your ability and the biotope description must be in agreement with your survey results.

Visit https://mhc.jncc.gov.uk/.

MEDIN compliance

Survey methods within this handbook have been created following the Marine Environmental Data and Information Network (MEDIN) data guidelines. The survey forms contain all mandatory MEDIN metadata fields required. This ensures your survey dataset, if completed fully, can be registered with MEDIN.

We recommend at the end of a survey or survey season to create a both a MEDIN guideline formatted record for the survey and a MEDIN discovery metadata record (one per survey). This discovery metadata record will ensure that your survey data is described in a standard format and publishing the discovery metadata to the MEDIN portal will mean others will know your data exists. The MEDIN Discovery Metadata Editor is an online tool that will help you create a record.

You can create an account at: www.dassh.ac.uk/medin_metadata/login. Details of how to create MEDIN compliant content can be accessed at https://www.medin.org.uk/medin-discovery-metadata-standard, and further assistance is available from the MEDIN Metadata Helpdesk (medin.metadata@mba.ac.uk - 01752 426237). MEDIN periodically run workshops on how to structure data into MEDIN guideline format and generate a discovery metadata record.

Visit www.medin.org.uk/.

Data storage

Your data should be well organised and stored securely. Consider how you are going to store the data securely and make them available in the long-term – be aware of data protection legislation if storing personal data, it is common practice with biological records to record who surveyed them and who identified what was found. Names are treated as personal data, community groups should seek advice on compliance with legislation regarding drafting appropriate privacy notices including identification of the appropriate legal basis for processing individual's names.

Sharing your data

Data must be quality assured before it can be submitted to national databases or data archiving centres.

MEDIN Portal

To share your discovery metadata records with others, the MEDIN Discovery Metadata Editor (see above) is a tool which allows you to publish your discovery metadata (one record per survey) to the MEDIN Portal. Ensure you tick the correct box to allow the publication of each discovery metadata record to the MEDIN portal. This will make your data more discoverable by others, documenting that a survey has taken place and is a part of good data management practice. This metadata record will not provide others with the results of your survey, but it does let others know the data exists.

Visit https://portal.medin.org.uk/portal/start.php

The NBN Atlas

The National Biodiversity Network (NBN) Atlas is a free online tool hosting the UK's largest collection of biodiversity information enabling data to be shared, analysed and researched. NBN Atlas is a tool to share the results of your survey.

Visit https://scotland.nbnatlas.org/.

Local Records Centres

If there is a Local Records Centre covering the area for your wildlife record then send the details to them. Contact them first to make sure you get it in the right format. They may be able to help with all the hard work from then on and submit the records to appropriate national databases and recording schemes and societies.

Visit www.brisc.org.uk/.

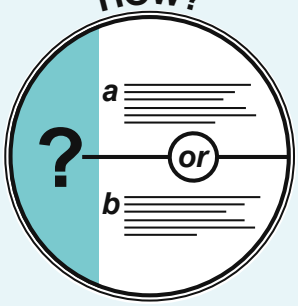
DASSH UK Data Archive Centre - *the archive for marine species and habitats data*

The benefit of submitting your data to a data archiving centre in MEDIN data guideline format is that the data can be easily shared with others and in a format others can easily use. While the MEDIN Portal (see above) will publish the associated metadata, if you would like to share the data results (i.e. the species and habitats information) with others, then data archiving centres can make this process straight forward. To archive your data, the data will need to be entered into MEDIN data guideline spreadsheets. Data guidelines relevant to your marine dataset can be found and downloaded for use here: www.medin.org.uk/data-standards/medin-data-guidelines. The DASSH UK Data Archive Centre is the suggested location for seabed species and habitats data.

Visit www.dassh.ac.uk.

METADATA
THE DATA BEHIND THE DATA

HOW?



Can you describe how the data was collected?
For example, our scientists collect data on board the research ships using water sample collectors called CTD'S

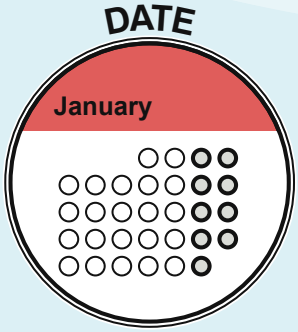
WHO?

Who collected and recorded the scientific data?
Data is collected by all kinds of scientists from different fields and organisations, this information is recorded with the data

WHY?

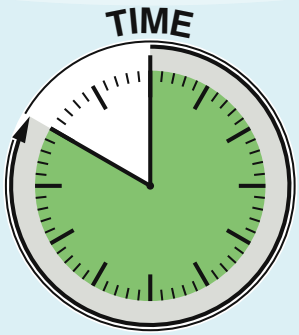
Can you explain why the data was collected?
For example, long-term data collection can be for evidence surrounding climate change

DATE



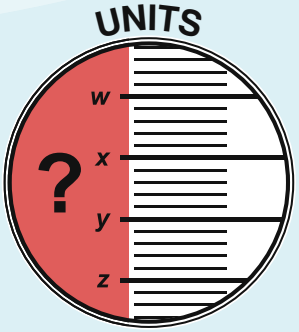
What was the precise date of the data collection?
Knowing which day, of which month and in which year the data were collected is very important to track changes in data

TIME



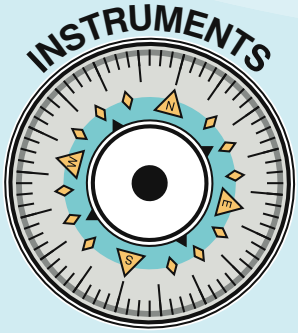
What time precisely was the data collected?
We record the exact hour, minute and second using the standard 24 hour notation method of hh:mm:ss, for example 13:18:54

UNITS



Which units will you use to measure the data?
Any data that does not fit the trend or looks unusual will be flagged as suspect and investigated to ensure quality

INSTRUMENTS

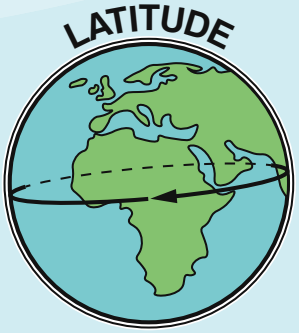


Which instruments are used to measure data?
Scientists use instruments to collect and analyse data, for example we could use Calibrated Verification Thermometers

LONGITUDE

What is the Longitude location of the data?
The distance east to west from the prime meridian in Greenwich, when used with Latitude a single point can be found

LATITUDE



What is the Latitude location of the data?
We measure the distance north or south in degrees along a meridian from the centre of the Earth's equator

METHOD

Can you explain the exact method step by step?
In the laboratory we state and record the processes completed by the scientist during data collection and analysis

POLICY

What is the policy on releasing the data?
Some data can be released immediately whilst other data is legally held by the scientist for 2 years as per the data policy

QUALITY CHECK

How have you checked the quality of the data?
All data is analysed and checked, any that does not fit the trend or looks unusual should be flagged and investigated

National Oceanography Centre

BODC British Oceanographic Data Centre
National Oceanography Centre

MEDIN

Community project profile form

Please fill in this form at the beginning of a community marine monitoring project. Store this within your community project and email a copy to communitymarinesurvey@nature.scot.
Community group name:
Lead contact(s):
The survey or monitoring interest: **Objectives summary:**
Why do you want to survey the marine environment?

What do you want to survey or monitor?

List methods from the handbook you are likely to use:

1.

2.

What information are you going to collect and how much time do you plan to spend collecting it?

Time allocated to survey or monitoring: list dates annually

Anticipated duration: _____ years

Who will analyse and use the information you collect?

Who will analyse:

Who will use:

Will the information you collect, and the frequency with which you collect it, meet your monitoring objectives? *(if the answer is no, revise your survey plans to address this)*

Will the data you collect be in a form that others (community members, academics, government etc.) can interpret and understand?

(if the answer is no, revise your survey plans to address this)

Project area

Describe what area your survey or monitoring project will survey within:

Insert a map of your project area with a project area box drawn on:

Survey sites codes for monitoring: - *create a site code for use in file naming conventions*

Site name	Code	Description
E.g. Loch Creran	CRER	Subtidal water body of Loch Creran

Other notes:

Survey plan template

This is a guideline for what should be included in a plan for marine biodiversity surveys.

Name of survey:

Date:

Lead contacts:

1. Target area:

2. Known habitats of interest:

3. Survey objectives:

4. Scope of work – length of survey, dates, what kind of survey and where you will survey.

5. Methods – survey methods and metadata (i.e. how data will be processed and stored, when and by whom).

6. Survey overview and priorities – include a map of the survey area show all survey stations and the priority of each station.

7. Local conditions – including tidal, weather, underwater conditions, presence of obstacles (such as creels or fish farms, ferry route etc.).

8. Station locations (details of GPS positions).

Definitions of habitats and survey designs

Marine life cover descriptions:

Marine life cover type	Description
Kelp forest	Large brown seaweeds growing in dense stands with the fronds forming an almost complete canopy. Kelp forest may be formed by a number of different seaweeds but the most common is *Laminaria hyperborea*, which often has many other seaweeds and animals growing on the stalks.
Kelp park	Scattered kelp plants whose fronds do not meet to form a continuous canopy.
Mixed seaweeds	This covers all other seaweeds and is likely to be found in shallow to medium depths (depending on the water clarity) on rocks. There may well be a mixture of green, brown and red species, the reds extending into deeper water as they can tolerate lower light levels.
Seagrass bed	The seabed sediment is covered with seagrass, usually eelgrass, *Zostera marina*.
Maerl bed	Living maerl is a purple-pink hard seaweed that forms spiky underwater 'carpets' on the seabed, known as 'maerl beds'. They are small nodules the size of gravel.
Encrusting pink algae	Hard crusts on the upper surfaces of rock. Typically they are pink or purple in colour and look like a thin covering of cement.
Tall animal turf	Animal turfs consist of a mixture of plant-like animal species which are attached to the rock surface. They occur mainly below the seaweed dominated surfaces or shallower where there are shaded surfaces where seaweeds cannot grow. Tall animal turf consists of species which are more than 10cm tall and includes things like dead men's fingers, plumose anemones, tall hydroids and hornwrack.
Short animal turf	Animal turfs consist of a mixture of plant-like animal species which are attached to the rock surface. They occur mainly below the seaweed dominated surfaces or shallower where there are shaded surfaces where seaweeds cannot grow. Short animal turf is less than 10cm and includes small hydroids, bushy bryozoans, anemones, sea squirts or encrusting sponges.
Animal beds	This is where a significant area of seabed is covered by large numbers of a single species creating a living reef. Mussel and brittle star beds are the most common, but scallops, flame shells and oysters can be found as beds in some areas. Remember to specify what your animal bed is.
Sediment with life apparent	Life may not be apparent on the surface but there may be tubes, burrows, mounds or tracks in evidence. Look out for burrowing anemones or sea cucumbers, siphons of bivalve shells or lugworm casts.
Barren sediment	No life or structures apparent.
Other - specify	

Substrate descriptions:

Substrate type	Description
Rocky reef	Bedrock, whether mainly flat or much more variable – it covers all rocks including softer rocks such as chalk or clays.
Boulders	Pieces of rock which are bigger than head size and are not part of the seabed. They are often jumbled together.
Cobbles and pebbles	Pieces of rock that are between the size of a 50p coin to head sized.
Sand and gravel	From smooth texture sand to very coarse texture with small stones. Dead maerl is also in this category of gravel.
Mud	Smooth silky texture.
Mixed ground	This is when sand, gravel and cobbles are all mixed together.
Wreckage	Any kind of artificial seabed, such as concrete blocks.
Other…	Please provide further details if the seabed does not fall into one of the categories above.

Survey quality descriptions:

To fill this in consider what the conditions were on the day (i.e. temperature, rain, water clarity, wind speed and direction, swell, shore exposure and human effort) as this will have an impact on the survey quality.

Survey quality	Description
Thorough	All species that can be clearly seen have been recorded.
Adequate	A high proportion of species were recorded (a few more would be found given extra time) or that some species may have been overlooked due to lack of expertise but the habitat was recorded to a good standard.
Incomplete	Insufficient time, expertise or lack of enough surveyors. The marine species were recorded to a basic standard and the survey forms are incomplete.

Species checklist template

Participants:

Survey type:

Survey name:

Location: **Date:**

Common name	Scientific name	Count	Image time taken

Notes:

Risk assessment template

RISK ASSESSMENT		
TASK		Date
Other information relevant to this task		
Identified hazards and risk ratings (without control measures)		**Insert score from matrix** S X L = R
Who might be harmed and how		
Control measures for identified hazards with new risk-rating		**Insert score from matrix** S X L = R
Emergency Arrangements (where risk rating remains 6 or more after all possible control measures have been taken)		
Further action (if applicable)		
Assessment by / date		

Advice and instructions on calculating the Risk Rating (S x L = R) are below.

Risk Rating

This is the numerical value derived from multiplying the **Hazard Severity** by the **Likelihood of Incident Occurring**.

This calculation will enable you to quantify the risk potential either actual or perceived, having first examined, reviewed and assessed existing controls; information available; and or best practices demonstrated.

Hazard Severity (S) - Explanation

A hazard is something with the potential to cause harm, which can vary in severity of outcome. The severity of a hazard should be rated according to the following table:

S4	A fatal injury or illness.
S3	A major injury or serious illness may occur eg fractures or loss of consciousness.
S2	Outcomes where persons are likely to be off work for more than three days or where there may be recurring injury or ill-health.
S1	All other outcomes, including where persons may incur injuries resulting in periods of absence from work for up to three days.

Likelihood of Incident Occurring (L) - Explanation

This is the consideration of how likely an incident is to occur, and should be rated according to the following table:

L4	High - Where it is certain that an incident will occur.
L3	Medium - Where it is probable that an incident will occur.
L2	Low - Where an incident is possible.
L1	Very Low – Where an incident is unlikely.

Calculating a Risk Rating (R)

This matrix shows how the Risk Rating is then calculated:

	L1	L2	L3	L4
S1	1	2	3	4
S2	2	4	6	8
S3	3	6	9	12
S4	4	8	12	16

The aim is to reduce the Risk Rating to as low as is reasonably practicable - a score of 3 or less is usually regarded as acceptable and scores of 12 or above are clearly unacceptable. Where the risk rating is greater than 3, consider again if all possible controls have been utilised. If not, then you need to consider carefully whether the activity should go ahead or not by analysing and comparing the benefits of carrying out activity against the actual or potential costs associated with the increased risk. Where risk ratings are 6 or above, emergency/contingency arrangements need to be included in the section of the risk assessment detailed for this purpose.

Photo quadrat label template

Quadrat label protocol

Use the following naming protocols to make photo labels for your quadrats. These should be included in photographs of the quadrat, but placed out with the quadrat frame. This can be created on laminated sheets with a marker pen or using a dive slate.

Rocky shore quadrats

Use the following naming protocol:

Site name, Zone, Quadrat number

e.g. Clachan Bridge (Isle of Seil), Lower shore, Q1

Feature focus: habitat quality quadrats

Use the following naming protocol:

Site name, Station/Transect, Quadrat distance number

e.g. Merkinch Nature Reserve (Inverness), Transect 2, Q3 at 15m

Naming conventions

File and photo naming protocols

Files and images should comply with a naming convention for ease to store, reference, find and use your survey data.

Clearly name images and files with the site and date details and the survey method completed.

E.g. an image of Loch Creran from a video transect on 27th August 2019, at survey station 5.

Format:

Site code_method code_station_date (YYYY MM DD)

CRER_VT_St05_2019 08 27

Site codes:

Please refer to your completed **community project profile** for the site code. In your project profile you should have determined what sites you would like to monitor and assigned a code to this site.

If a new site it created, your project profile should be updated accordingly.

Survey method codes:

Method	Code
Species Image Library	SIL
Photo Station	PS
Rocky Shore Zonation	RSZ
Rocky Shore Profile	RSP
Rocky Shore Quadrat Sampling	RSQ
Underwater Marine Life Observation	MLO
Underwater Video Transect	VT
Feature Focus: Habitat Mapping	HM
Feature Focus: Habitat Quality	HQ

Storing images and footage

Photographs and video footage can be a large file size and cause problems with storage. Where possible, images can be compressed to keep file sizes small.

Clapperboard template

Date	**Station number**
Survey name	**Location** (e.g. Loch Linnhe)

Glossary

Algae	A photosynthetic, plant-like single- or multi-cellular organism.
Animal bed	Used to describe when a marine animal forms a bed like structure that is greater than 5mx5m.
Bathyscope	Underwater viewer that can be used from a boat or dry land, generally as a clear bottom viewing cone. It works by eliminating both water surface glare and internal reflection, thereby allowing underwater viewing as far as water clarity and light will permit.
Biodiversity	Biodiversity is the shortened form of two words “biological” and “diversity.” It refers to all the variety of life that can be found on Earth (plants, animals, fungi and microorganisms) as well as to the communities that they form and the habitats in which they live.
Boat draught	The vertical distance between the waterline and the bottom of the hull (keel).
BSL	Below sea level (water depth).
BST	British Summer Time (time zone).
Colonial	Several individual organisms (of the same species) living together in close association.
Datum	A known, fixed point.
DDV	A drop down video system (DDV) is a marine survey equipment setup that is typically an underwater camera and lights on a robust sled/frame. DDV systems generally have a live stream of footage to the surface, built in depth sensors and lasers to provide a scale to estimate the field of view.
Ebb and flood tide	Ebb is the tidal phase during which the water level is falling and flood the tidal phase during which the water level is rising.
Eddies	An eddy is a circular current of water.
Epiphyte	A small plant that grows attached to another plant.
GIS	Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present all types of geographical data.
GPS	Global Positioning System used to navigate and mark locations.
Inshore water	Scotland’s inshore waters are the marine region within 12 nautical miles of the coast.
Intertidal	The area of coast which is covered by water at high tide, and uncovered at low tide.
Intertidal	The intertidal zone or “littoral zone” is the term used to describe the seashore which is covered during high tide and exposed during low tide.

Marine life cover	The dominating marine community on the seabed or shoreline.
MPA	Marine Protected Area.
Native range	A species range is the area where a particular species can normally be found during its lifetime.
Non-native species	Species introduced or spread from one region to another outside their normal range.
PMF	Priority Marine Feature. This is used in Scotland to describe features characteristic of the Scottish marine environment. The list of PMFs is used to focus conservation and they are given policy protection in the National Marine Plan.
Polecam	A polecam is a video camera attached to a pole that can be deployed to record underwater.
Quadrat	A defined area for scientific sampling, and the frame that is used to define this area.
Random	Lack of pattern or predictability.
ROV	Remotely Operated Vehicle is an unoccupied underwater robot that is connected to the surface by a cable.
SCUBA	Self-Contained Underwater Breathing Apparatus.
Sessile	Permanently attached to the substrate. Can only move by external forces (such as water currents).
Slack water	A short period in a body of tidal water when the water is completely unstressed, and there is no movement either way in the tidal stream, which occurs before the direction of the tidal stream reverses.
Species	A name of a living organism.
Spring tide	A tide in which the difference between high and low tide is the greatest. This results in very low, low tides and very high, high tides.
Substrate	the surface or material on or from which an organism lives (e.g. rock, cobbles or mud).
Subtidal	The area of coast which is covered by water at low tide.
Taxonomic hierarchy	Taxonomic hierarchy is the process of arranging various organisms into successive levels of the biological classification.
Tether	The cable that connected an underwater camera to the surface, which transfers information or power.
UTC	Universal Time Coordinated (time zone).

1.1 Photo station recording form

Survey and Site Information

Participant name(s):

Survey type: Photo station, Community-led marine biodiversity monitoring handbook

Survey name:

Data owner:

Photography details:

1. **Camera make and model:**

2. **Device configuration:**

Field recording

Station name:

Date:

Time: UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details:

Location:

GPS position (WGS84 in decimal degrees): Lat ..... Long .....

GPS accuracy (m):

Position fix: GPS device ☐ Chart ☐ Web mapping site ☐

Description: *please include a description of the photo station, information on site access and any additional notes.*

Image time taken	Compass bearing	Description

Sketch map

Optionally, you can take a photo of your site sketch map and include this as a photo in your upload of photo station data.

2.1 Rocky shore zonation recording form

Survey and site information

Participant name(s):

Survey type: Rocky shore zonation survey, Community-led marine biodiversity monitoring handbook

Survey name:

Date:

Survey start time: UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details:

Location:

Positional fix: GPS device ☐ Chart ☐ Web mapping site ☐

GPS accuracy (m):

Data owner:

Description: *please include a description of the survey information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

See definitions of habitats and survey designs within the appendix (page 105).

Context photography

Photography details:

1. **Camera make and model**:

2. **Device configuration**:

Photography for data management:

1. Site access
2. Overall site extent (image showing site from high to low shore)
3. Features of interest (such as whole shore photographs to show algal cover)
   Rare or unusual species, species of conservation interest

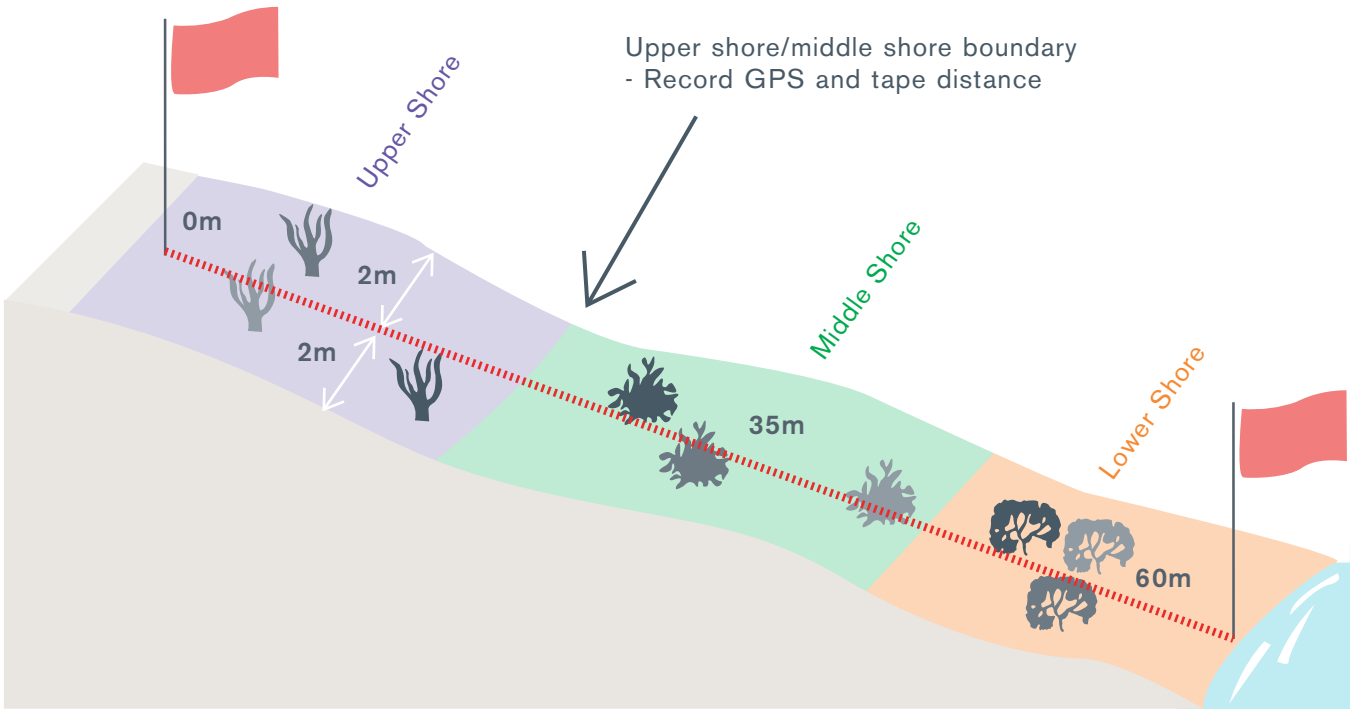
Waypoint	Image/ video time taken	Latitude	Longitude	Compass bearing	Description

Sketch map

Map of the site- survey route

Notes:

▼ **Rocky shore zonation survey diagram of shore zones within 2m either side of a transect line.**



Field recording

Survey name: ..... **Location** ..... **Date:** .....

Station name: ..... **Transect number:** 1 ☐ 2 ☐ 3 ☐

Results

Please follow the rocky shore zonation survey methods. *The GPS position must be recorded in decimal degrees. If using any other format, it must be converted to WGS84 decimal degrees, and state the format it was recorded in and if a conversion is used.*

Setting up

Feature	Tape distance (m)	Latitude	Longitude	Image time taken	Compass bearing
Marker peg/ high water					Looking down transect:
Low water					

Zone boundary recording

	Zone	Tape distance (m)	Latitude	Longitude	Image time taken	Description
Marker peg	**Upper start**					
	Upper end / mid start					
	Middle end / low start					
	Lower end					

Zone biodiversity recording

Zone	Substrate	Marine life – main species	Extra notes	Image(s) time taken
Upper shore Zone				
Middle shore Zone				
Lower shore Zone				

2.2 Rocky shore profile recording form

Survey and site information

Participant name(s):

Survey type: Rocky shore profile, Community-led marine biodiversity monitoring handbook

Survey name:

Date:

Low water reference station reading time: UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

Data owner:

Description: *please include a description of the photo station, information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

See definitions of habitats and survey designs within the appendix (page 105).

Shore height measurements

Participant name(s): .....

Survey name: ..... **Location** ..... **Date:** .....

Station name: ..... **Transect number:** 1 ☐ 2 ☐ 3 ☐

Reading point name	Tape distance (m)	Levelling pole height reading (m)
Low water reference station		
e.g. A	*65m*	*3.27*

Reading point name	Tape distance (m)	Levelling pole height reading (m)

Did you move the tripod? Y ☐ N ☐

If yes please fill in the below

Please record one measuring pole height reading from both tripod locations

Reference station tape distance = ____m

High water tripod pole reading **(C)** = _____m

Mid shore tripod height reading **(B)** =_____m

2.3 Rocky shore quadrat sampling recording form

Survey and site information

Participant name(s):

Survey type: Rocky shore quadrat sampling, Community-led marine biodiversity monitoring handbook

Survey name:

Date:

Survey start time: UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details:

Location:

Positional fix: GPS device ☐ Chart ☐ Web mapping site ☐

GPS accuracy (m):

Data owner:

Description: *please include a description of the photo station, information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

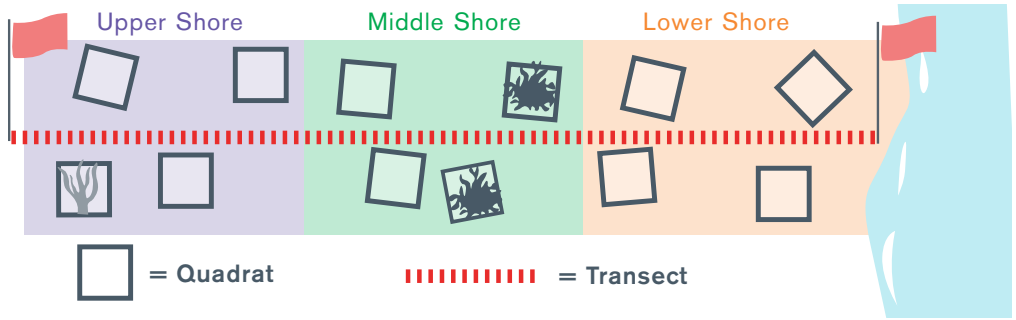
See definitions of habitats and survey designs within the appendix (page 105).

Quadrat results

Follow survey guidance to complete the rocky shore quadrat sampling survey. Common species found in each zone have been provided as a guide. Record all species you see within your quadrat, adding new species to the list.

Method

1. Estimate % coverage of all barnacles, seaweed and algae, colonial animals such as sponges and lichens in the quadrat. Percentages should be estimated down to 10%, below 10% record P for present.
2. Count individuals of non-colonial animals (such as shells, dogwhelks and limpets).



◀ Placement of quadrats on a rocky shore.

Survey zone: upper shore

Participant name(s): .....

Survey name: ..... **Location** ..... **Date:** .....

Transect number: 1 ☐ 2 ☐ 3 ☐

Species	% Coverage			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
GPS position **Lat and long**	Lat: Long:	Lat: Long:	Lat: Long:	Lat: Long:
Quadrat label name				
Image time taken				
Black tar lichen (Genus *Verrucaria sp.*)				
Black lichen (*Lichina pygmaea*)				
Channelled wrack (*Pelvetia canaliculata*)				
Spiral wrack *(Fucus spiralis)*				
Barnacles sp.				
	Count of animals			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Small periwinkle (*Melarhaphe neritoides*)				
Rough periwinkle (*Littorina saxatilis*)				

Survey zone: middle shore

Participant name(s): .....

Survey name: ..... **Location** ..... **Date:** .....

Transect number: 1 ☐ 2 ☐ 3 ☐

Species	% Coverage			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
GPS position **Lat and long**	Lat: Long:	Lat: Long:	Lat: Long:	Lat: Long:
Quadrat label name				
Image time taken				
Broadleaf sea lettuce (*Ulva lactuca)*				
Gutweed (*Ulva intestinalis*)				
Knotted wrack (*Ascophyllum nodosum*)				
Saw wrack or toothed wrack (*Fucus serratus*)				
Bladder wrack (*Fucus vesiculosus*)				
Thongweed (*Himanthalia elongata*)				
Oarweed (*Laminaria digitata*)				
Japanese wireweed (*Sargassum muticum*)				
Irish moss (*Chondrus crispus*)				
Encrusting coralline algae (Genus *Lithothamnion sp.*)				
False Irish moss (*Mastocarpus stellatus*)				
Purple laver (*Porphyra umbilicalis*)				
Pepper dulse (*Osmundea pinnatifida*)				
Bread-crumb sponge (*Halichondria panicea*)				
Barnacles sp.				
Common coralline/ Coral weed *(Corallina officinalis)*				
	Count of animals			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Beadlet anemone (*Actinia equina)*				
European painted top shell (*Calliostoma zizyphinum*)				
Grey top shell (*Gibbula cineraria*)				
Common or edible periwinkle (*Littorina littorea*)				
Blue mussel (*Mytilus edulis*)				
Dog whelk (*Nucella lapilus*)				
Limpets (Genus *Patella sp.*)				
Purple top shell (*Steromphala umbilicalis*)				
Lined top shell (*Phorcus lineatus*)				
Flat periwinkle (*Littorina obtusata*)				

Survey zone: lower shore

Participant name(s): .....

Survey name: ..... **Location** ..... **Date:** .....

Transect number: 1 ☐ 2 ☐ 3 ☐

Species	% Coverage			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
GPS position Lat and long	Lat: Long:	Lat: Long:	Lat: Long:	Lat: Long:
Quadrat label name				
Image time taken				
Broadleaf sea lettuce (*Ulva lactuca)*				
Gutweed (*Ulva intestinalis*)				
Knotted wrack (*Ascophyllum nodosum*)				
Saw wrack or toothed wrack (*Fucus serratus*)				
Bladder wrack (*Fucus vesiculosus*)				
Thongweed (*Himanthalia elongata*)				
Oarweed (*Laminaria digitata*)				
Japanese wireweed (*Sargassum muticum*)				
Irish moss (*Chondrus crispus*)				
Encrusting coralline algae (Genus *Lithothamnion sp.*)				
False Irish moss (*Mastocarpus stellatus*)				
Purple laver (*Porphyra umbilicalis*)				
Pepper dulse (*Osmundea pinnatifida*)				
Bread-crumb sponge (*Halichondria panicea*)				
Barnacles sp.				
Common coralline/ Coral weed *(Corallina officinalis)*				
Dulse *(Palmaria palmata)*				
	Count of animals			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Beadlet anemone (*Actinia equina)*				
European painted top shell (*Calliostoma zizyphinum*)				
Grey top shell (*Gibbula cineraria*)				
Common or edible periwinkle (*Littorina littorea*)				
Blue mussel (*Mytilus edulis*)				
Dog whelk (*Nucella lapilus*)				
Limpets (Genus *Patella sp.*)				
Purple top shell (*Steromphala umbilicalis*)				
Lined top shell (*Phorcus lineatus*)				
Flat periwinkle (*Littorina obtusata*)				
Snakelocks anemone *(Anemonia viridis)*				
Blue-rayed limpet *(Patella pellucidum)*				

Additional recording space

Participant name(s): ....

Survey name: .... **Location** .... **Date:** ....

Transcect number: 1 ☐ 2 ☐ 3 ☐

Survey zone: Upper shore ☐ Middle shore ☐ Lower shore ☐

Species	% Coverage or individual count			
	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Quadrat label name				
Image time taken				

3.1 Underwater marine life observation recording form

Fill in survey and site information on the underwater marine life observations data recording sheet before beginning the survey. Data for each survey station within the survey can be added to a new row in the table.

Survey and site information

Participant name(s):

Survey type: Underwater marine life observation, Community-led marine biodiversity monitoring handbook

Survey name:

Date: **Survey start time:** UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details

Location:

Positional fix: GPS device ☐ Chart ☐ Web mapping site ☐ ROV estimate ☐ Underwater GPS ☐

GPS accuracy (m):

Data owner:

Description: *please include a description of the survey, information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

See definitions of habitats and survey designs within the appendix (page 105).

Sampling device: Polecam ☐ DDV ☐ ROV ☐

Depth derived from:

Depth sensor on camera system ☐ Length of rope/ tether ☐

Depth sensor on boat (adjust depth for boat draught) ☐

Height of camera: *i.e. average height of camera above seabed during survey* _____(m)

Camera make and model:

Device configuration: *(i.e. the camera set-up, any GPS or depth overlay, lenses used, scaling lasers etc.)*

Lights make and model:

Survey name: ..... Sheet number: .....

Participant name(s): ..... Location: ..... Date: .....

Station	Image / video time taken	GPS position	Depth (m)	Substrate	Marine life cover	**Marine species** - estimate how many per 1m² within the survey area. If unknown - indicate P for present.
		Lat Long				
		Lat Long				
		Lat Long				
		Lat Long				
		Lat Long				

Survey name: ..... Sheet number: .....

Participant name(s): ..... Location: ..... Date: .....

Station	Image / video time taken	GPS position	Depth (m)	Substrate	Marine life cover	**Marine species** - estimate how many per 1m² within the survey area. If unknown - indicate P for present.
		Lat Long				
		Lat Long				
		Lat Long				
		Lat Long				
		Lat Long				

3.2 Underwater video transect recording form

Fill in survey and site information before beginning the survey. Fill in a new row in the recording table for each survey station.

Survey and site information

Participant name(s):

Survey type: Underwater video transect, Community-led marine biodiversity monitoring handbook

Survey name:

Date: **Time zone used:** UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details

Location:

Positional fix: GPS device ☐ Chart ☐ Web mapping site ☐ ROV estimate ☐ Underwater GPS ☐

GPS accuracy (m):

Data owner:

Description: *please include a description of the survey, information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

See definitions of habitats and survey designs within the appendix (page 105).

Sampling device: Polecam ☐ DDV ☐ ROV ☐

Depth derived from:

Depth sensor on camera system ☐ Length of rope/ tether ☐

Depth sensor on boat (adjust depth for boat draught) ☐

Height of camera: *i.e. average height of camera above seabed during transect* _____(m)

Camera make and model:

Device configuration: *(i.e. the camera set-up, any GPS or depth overlay, lenses used, scaling lasers etc)*

Lights make and model:

Underwater video transect recording form

Survey name: ..... Sheet number: .....

Participant name(s): ..... Location: ..... Date: .....

Survey plan – *use the survey plan template.*

A survey plan must have been completed. Please use the survey plan template (*page 104*) to create a survey plan in advance of your survey and take this in the field with you to complete your survey. Specifically, ensure you have a copy of the map with planned stations and the planned survey station GPS positions.

Station	Time start	Time end	GPS position start	GPS position end	Depth start (m)	Depth end (m)	Way Pt in and out	Video notes (main substrate and main marine life cover)
			Lat Long	Lat Long			In Out	Substrate: Marine life cover: Possible PMF? Yes ☐ No ☐
Description: - *additional notes*				Marine life species: - estimate how many per 1m² within the survey area. If unknown - indicate P for present				
			Lat Long	Lat Long			In Out	Substrate: Marine life cover: Possible PMF? Yes ☐ No ☐
Description:				Marine life species:				
			Lat Long	Lat Long			In Out	Substrate: Marine life cover: Possible PMF? Yes ☐ No ☐
Description:				Marine life species:				

Survey name: ..... Sheet number: .....

Participant name(s): ..... Location: ..... Date: .....

Station	Time start	Time end	GPS position start	GPS position end	Depth start	Depth end	Way Pt in and out	Video notes (main substrate and main marine life cover)
			Lat Long	Lat Long			In Out	Substrate: Marine life cover: Possible PMF? Yes ☐ No ☐
Description: - *additional notes*				Marine life species: - estimate how many per 1m² within the survey area. If unknown - indicate P for present				
			Lat Long	Lat Long			In Out	Substrate: Marine life cover: Possible PMF? Yes ☐ No ☐
Description:				Marine life species:				
			Lat Long	Lat Long			In Out	Substrate: Marine life cover: Possible PMF? Yes ☐ No ☐
Description:				Marine life species:				

3.3 Feature focus: habitat mapping recording form

Survey and site information

Participant name(s):

Survey type: Feature focus: habitat mapping, Community-led marine biodiversity monitoring handbook

Survey name:

Date: **Survey start time:** UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details

Location:

Positional fix: GPS device ☐ Chart ☐ Web mapping site ☐ ROV estimate ☐ Underwater GPS ☐

GPS accuracy (m):

Data owner:

Description: *please include a description of the survey, information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

See definitions of habitats and survey designs within the appendix (page 105).

Access: Foot (intertidal) ☐ Snorkelling ☐ Bathyscope ☐

Camera make and model:

Device configuration: *(i.e. the camera set-up, any GPS or depth overlay, lenses used, scaling lasers etc)*

N Sketch map

Survey name: ..... Sheet no.: .....

Participant name(s): .....

Location: ..... Date: .....

The GPS position must be recorded in WGS84 decimal degrees. If using any other format, it must be converted to decimal degrees, and state the format it was recorded in and record that you used a conversion.

Habitat boundary:

Waypoint name	**GPS position**	**Boundary description –** *defined, patchy or gradual*	**Additional notes**	**Image time taken**
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			
	Lat Long			

Mapped habitat details:

GPS position	**Depth (m)**	**Substrate**	**Marine life cover**	**Marine species** - estimate how many per 1m² within the survey area. If unknown - indicate P for present.	**Image time taken**
Lat Long					

3.4 Feature focus: habitat quality recording form

Survey and site information

Participant name(s):

Survey type: Feature focus: habitat quality, Community-led marine biodiversity monitoring handbook

Survey name:

Date: **Survey start time:** UTC (+0000) ☐ BST (+0100) ☐ *(UTC preferred)*

GPS details

Location:

Positional fix: GPS device ☐ Chart ☐ Web mapping site ☐ ROV estimate ☐ Underwater GPS ☐

GPS accuracy (m):

Data owner:

Description: *please include a description of the survey, information on site access and any additional notes.*

Survey quality: Thorough ☐ Adequate ☐ Incomplete ☐

See definitions of habitats and survey designs within the appendix (page 105).

Camera make and model:

Device configuration: *(i.e. the camera set-up, lenses used etc)*

N Sketch map

Mussel beds

Survey name: ..... **Sheet no.:** .....

Participant name(s): ..... **Location:** ..... **Date:** .....

Station name: ..... **Transect number:** 1 ☐ 2 ☐ 3 ☐

GPS position (WGS84 in decimal degrees)

Transect start: Lat ..... Long .....

Transect end: Lat ..... Long .....

Transect compass bearing: .....

Quadrat position (m)	Substrate	Comments (e.g. macrofauna – crabs sp x 1, brittle star x 5 etc)	% Live coverage	% Dead coverage	% Algae coverage
5					
10					
15					
20					
25					
30					
35					
40					
45					
50					
Average					

Seagrass beds

Survey name: ..... Sheet number: .....

Participant name(s): ..... Location: ..... Date: .....

Station name: .....

Transect number: 1 ☐ 2 ☐ 3 ☐ **Transect compass bearing:** .....

GPS position (WGS84 in decimal degrees)

Start of transect: Lat ..... Long ..... End of transect: Lat ..... Long .....

Quadrat position (m)	Substrate	**Comments** (e.g. macrofauna – crabs sp x 1, brittle star x 5 etc)	% Seagrass coverage	Seagrass species	% Algae coverage	Canopy height	% Epiphyte coverage
5							
10							
15							
20							
25							
30							
35							
40							
45							
50							
Average							

Notes

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