

Sea Search Manual

A guide for community based monitoring of Victoria's marine national parks and marine sanctuaries





Authorised and published by Parks Victoria
Level 10, 535 Bourke St, Melbourne VIC 3000
First published 2013. Updated 2018
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Cover Image:

Mushroom Reef Marine Sanctuary

Inside cover image:

Seagrass and algal community in Western Port

Contributors:

Matthew Browne, Jacqui Pocklington,
Amanda Franklin, Steffan Howe, Mark Rodrigue,
Jonathan Stevenson and Ines Krak.

Design and layout:

Matthew Browne

Image acknowledgments:

Chris Hayward, Chris Neufeld, Deakin University,
Friends of Beware Reef, Jacqui Pocklington,
Jan Carey, Jonathan Stevenson, Julian Finn,
Leon Altoff, Mark Norman, Mark Rodrigue,
Matthew Browne, Museum Victoria, Natasha
Johnson, NIMPIS, and Rod Watson.

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 This symbol indicates a page intended for printing and to be taken to Sea Search activities - such as method sheets, data sheets and I.D. sheets. As well as appearing next to relevant pages in this table of contents, you will find this symbol in the top right corner of the pages themselves. These pages are available to download from the Sea Search website, or can be photocopied directly from this document.



Introduction

Sea Search

Sea Search is a great example of applying the philosophy of Healthy Parks Healthy People to the marine environment, where both the park and the individual benefit from involvement in the monitoring activity.

Sea Search is a Parks Victoria program that encourages and provides opportunities for community participation in marine data collection and surveillance within Victoria's Marine Protected Area [MPA] system, with a focus on marine national parks and marine sanctuaries. The program provides a range of opportunities for volunteers with varying interests and skill levels.

While Parks Victoria conducts its own significant marine monitoring and research program, community participation in gathering information adds enormous value. Sea Search assists in improving understanding of natural assets and processes, in the early detection of change, identification of threats, and provides meaningful opportunities for citizens to make an

active and welcome contribution to the management of the MPA system. Participation by local communities in monitoring further promotes stewardship and helps to build community connections, as well as local understanding and appreciation of marine values.

In addition to the opportunities for community groups to collect useful information, Sea Search is a lot of fun and has many other benefits to individuals and community groups. Spending time in, and becoming familiar with, local MPAs provides many opportunities for social interaction, making friends with people that share similar interests, and providing valuable opportunities for spending quality time in the natural environment.



Victorian marine environments

Australia's southern waters are unique. Ninety per cent of our marine plants and animals are found nowhere else on earth.

The Victorian marine environment supports an extraordinary biodiversity of marine plants and animals, many of which are found only in southern Australia's cool temperate waters. From the piers of the inner city to the rugged rocky reefs on the ocean shores, more than 12,000 marine species can be found.

A wide diversity of marine habitats are found in Victorian waters including intertidal rocky reefs, subtidal rocky reefs, seagrass meadows, mudflats, mangroves and coastal saltmarsh, sandy beaches, sandy and muddy bottom habitats, kelp forests, and areas of open water. Artificial surfaces such as piers, jetties and breakwaters also provide habitats for some marine species.

Below: A huge diversity of species is waiting to be discovered in Victoria's marine protected areas, such as this reef teeming with life at Ricketts Point Marine Sanctuary.



Marine protected areas

A representative system: the location of Victoria's 24 marine national parks and marine sanctuaries was determined following an extensive consultative and analytical process, ensuring the ongoing protection of representative examples of each bioregion, across the state.

Victoria's marine environment is divided into five main bioregions based around the biological communities found in different areas of the state. These include the far east, far west, the bays and inlets, the coastal areas facing Bass Strait, and a special area around Wilsons Promontory which is an important transition zone separating species in the east from those in the west.

Across Victoria there are 30 marine protected areas (MPAs). These include marine national parks, marine sanctuaries, marine and coastal parks, marine parks, and a marine reserve.

MPAs span Victoria's five marine bioregions and aim to conserve and protect ecological processes, habitats and associated flora and fauna. Marine

national parks and marine sanctuaries are highly protected "no-take" areas, while the other MPAs have different restrictions.

Victoria's system of marine national parks and marine sanctuaries was declared in 2002, ensuring a high level of protection is given to representative areas of the state's marine environment. These 'wet' parks cover 5.3% of the state's waters and protect marine life in the same way that national parks protect species and habitats on land. All forms of fishing or collection are prohibited within marine national parks and marine sanctuaries. Marine national parks differ from marine sanctuaries in size, the former protect entire ecosystems, while marine sanctuaries generally protect isolated features.

Victorian marine national parks and sanctuaries

- | | | |
|--|--|--|
| 1 Discovery Bay Marine National Park | 9 Barwon Bluff Marine Sanctuary | 17 Churchill Island Marine National Park |
| 2 Merri Marine Sanctuary | 10 Port Phillip Heads Marine National Park | 18 Bunurong Marine National Park |
| 3 The Arches Marine Sanctuary | 11 Point Cooke Marine Sanctuary | 19 Wilsons Promontory Marine National Park |
| 4 Twelve Apostles Marine National Park | 12 Jawbone Marine Sanctuary | 20 Corner Inlet Marine National Park |
| 5 Marengo Reefs Marine Sanctuary | 13 Ricketts Point Marine Sanctuary | 21 Ninety Mile Beach Marine National Park |
| 6 Eagle Rock Marine Sanctuary | 14 Yaringa Marine National Park | 22 Beware Reef Marine Sanctuary |
| 7 Point Addis Marine National Park | 15 Mushroom Reef Marine Sanctuary | 23 Point Hicks Marine National Park |
| 8 Point Danger Marine Sanctuary | 16 French Island Marine National Park | 24 Cape Howe Marine National Park |



Monitoring and management

As the manager of Victoria's MPAs, Parks Victoria is responsible for protecting and improving the ecological condition of these important marine areas.

To measure progress against achieving protection goals up-to-date information about the abundance, distribution and health of marine plants and animals, as well as an understanding of threats to the natural values of these areas, is required. Monitoring, defined as repeated measurements or observations over time, is a way of collecting this information.

Marine ecosystems worldwide are under increasing pressure from population expansion, illegal fishing, pollution, urban development, marine pests, and climate change. Many of these threats also impact on Victoria's marine environment and protected areas. Monitoring improves Parks Victoria's ability to make informed and effective management decisions in the context of these pressures, ensuring the ongoing health and conservation of the natural values of Victoria's marine national parks and sanctuaries.

Below: Parks Victoria is committed to ensuring the ongoing health and conservation of Victoria's marine protected areas.



A range of Sea Search methods

- Easy:** Can be done by new volunteers
- Moderate:** Can be done by volunteers with some experience and training
- Difficult:** Can be done by experienced volunteers with relevant training

Sea Search is an inclusive program, where participants from all walks of life are encouraged to participate. Depending on interests, expertise, and access, volunteers can select from a range of monitoring tasks to undertake within their chosen marine national

park or marine sanctuary (Table 1). Note that methods rated as 'Difficult' are extensions to the preceding 'Moderate' methods, and are to be undertaken in conjunction with them (e.g. 2.3 must be done only in addition to 2.1 and 2.2, not by itself).

Quantitative activities occur either seasonally or annually, whilst qualitative activities can be undertaken at anytime. Your local Parks Victoria Ranger can assist in selecting appropriate monitoring tasks for your local MPA.

Table 1: A range of methods

	Qualitative			Quantitative	
	Methods for all habitats			Intertidal reef	Seagrass (small and large sites)
Easy	1.1 Fixed Point Photos	1.2 Species Image Library	1.3 Sea Search Patrol		
Moderate				2.1 Cover quadrats (algae & invertebrates)	3.1.1 + 3.2.1 Quantifying seagrass condition (rapid)
					3.3.1 and 3.3.3 Seagrass boundary methods
Difficult				2.2 Counting snails and other mobile creatures	3.1.2 and 3.2.2 Quantifying seagrass condition (detailed)
				2.3 Catch per unit effort - snail and limpet sizes	



Getting started

Safety

The safety of Sea Searchers visiting the coast is paramount. In planning for a monitoring excursion the sometimes challenging coastal environment must be considered.

Hazards include: weather, waves, slippery surfaces, and potentially harmful marine creatures. However, with a little planning, all participants can enjoy a safe and comfortable Sea Search excursion.

It is the responsibility of each participant to ensure they are wearing the appropriate clothing and footwear for a planned activity. Shoes must be sturdy, with a solid sole, covered toes and good grip. Protection against the elements, such as a hat, sunscreen, sunglasses and water bottle are also important. If rain is predicted ensure adequate wet weather gear, such as a jacket or plastic poncho, and keep a change of warm, dry clothes just in case.

A current first aid kit must be at the monitoring site (all Parks Victoria rangers are first aid trained). Some form of communication, such as a mobile phone with good service, should be available to ensure that contact can be made with emergency services if required. Also ensure each participant has filled out a Parks Victoria volunteer form which includes emergency contact details as this is required for insurance purposes.

While the best laid plans to undertake a survey are often done a long way ahead of time, the weather can throw a last minute spanner in the works, making what would have been a benign excursion into a high risk activity. The night prior to, and on the morning of a planned Sea Search activity, assess the weather forecast, tidal movement, and sea conditions. This can be done by checking the Bureau of Meteorology website.

Alternative dates for surveys, and a willingness to postpone activities, should be considered in the event of bad weather. Make sure the person organising the activity has all the participant's contact details to update them if the event needs to be cancelled.

When on site ensure someone acts as a lookout for sudden large waves and changes in weather conditions.

A handy checklist of things to consider before, during and after each Sea Search activity has been included in the appendix of this document, and will help ensure the safety of all participants is provided for.

Key safety messages for all participants:

Wear appropriate footwear that encloses and protects your feet at all times.

Don't run - always walk carefully to avoid slipping or tripping.

Keep an eye on conditions - especially waves - never turn your back on the sea.

Don't put your hands where you can't see them to avoid potentially harmful marine creatures such as cone snails and blue-ringed octopus.

Don't handle cone shells and blue-ringed octopuses, or any other marine creature that you don't recognise - even animals like urchins, snails and anemones can irritate some people's skin.

Don't go too close to the edge of a rock platform, especially in rough conditions.

Always wear appropriate protective clothing. Slip, slop and slap in warmer weather; stay warm and dry in cooler weather.

Have a first aid kit available.

Bring a water bottle. Working in exposed environments can be dehydrating.

Minimal impact guidelines

To help protect the natural areas Sea Search monitors, it is important to make sure our activities have a minimal impact on the environment.

Sea Search volunteers should endeavour to:

Tread lightly – avoid trampling on plants and animals while monitoring.

Do not remove anything, living or non-living, from marine protected areas.

Minimise handling of animals where possible and return them right side up and to their original location (preferably somewhere damp so they don't dry out).

Avoid turning rocks over, this can break the moisture seal causing stress to the creatures underneath.

Take all rubbish away with you.

Marine creatures and plants have sensitive skin – please ensure your hands are sunscreen and chemical-free before handling them.



Logistics

Location

Sea Search is primarily focused on collecting data for Victoria's marine national parks and marine sanctuaries. The program has already been established for some time at numerous locations along the Victorian coast. Contact your local Parks Victoria Ranger to connect with a Friends Group and find out when the next Sea Search activity is taking place.

If your local or favourite MPA is not currently being monitored through Sea Search, contact local Parks Victoria staff to help you establish a community group and start Sea Searching!

To contact a Parks Victoria Ranger for your marine national park or marine sanctuary, or other reserves, call 13 1963 and ask to be connected to the office associated with your chosen park. Alternatively, email your enquiries to seasearch@parks.vic.gov.au

The same approaches for marine monitoring can of course be applied at any suitable location along the coast outside MPAs. This manual provides useful techniques for communities to use; this could be in conjunction with other groups such as Coastcare). Data

for these other locations cannot however be uploaded to the Sea Search data base which is established for the exclusive collection and storage of information related to MPAs.

Complementary marine citizen science programs including Reefwatch and Reef Life Survey (see links in appendix) provide other community monitoring approaches than can also be applied across the entire coast, including within marine national parks and marine sanctuaries.

Timing

Setting an appropriate date for monitoring must be done in consultation with a local tide chart (don't forget to adjust for daylight savings) to ensure that the conditions will be suitable for the activity. Tide tables are developed many years in advance and are accessible from the Bureau of Meteorology's website.

In general the best time for undertaking intertidal Sea Search activities is between two hours before and two hours after the predicted time of low tide. It is

however important to recognise that tides do vary in the extent to which they rise and fall and there are some low tides that will not suit surveys. Generally, if the tide is less than 0.4m it will be a good for an intertidal survey. However, in western Victoria locations such as Merri Marine Sanctuary, 0.2m is better.

Tide heights and movement are also important when undertaking seagrass methods. Subtidal seagrass surveys will be undertaken using diving and

snorkelling equipment, so it may be best to survey around slack water if the site is affected by tidal currents. Intertidal seagrass species are easier to survey at low tides.

Always discuss the timing of activities with your park ranger, who can inform you about local site conditions and help determine the best times to run a Sea Search activity.

Frequency

Typically, Sea Search methods have been designed to occur seasonally, i.e. 4 times per year. Seagrass boundary measurements can take place annually, whilst Species Image Library and Sea Search Patrol may occur opportunistically, at any time. Whether undertaking activities seasonally or annually, it is best to plan your Sea Search activities for the same time each season, or the same time each year, to

eliminate seasonal variations and obtain the most useful data and observations.

There can be seasonal effects on the distribution and types of animals and plants found on rocky or seagrass intertidal areas. Some seaweed, for example, grows in greater densities during spring, and dies back during summer. This is a natural seasonal variation. Over time it is important to identify this as a natural trend so it

isn't confused with a disturbance, this is why regular and consistent seasonal monitoring is required.

Furthermore, observations by interested community members aid in the recognition of potentially threatening events (such as the presence of a marine pest); bringing them to a ranger's attention will help ensure a timely response from the park manager should it be required.

Quality control

In addition to encouraging community participation in MPA management, the Sea Search program has the fundamental aim of providing data of sufficient quality to complement contracted scientific monitoring of Victoria's MPAs. Sea search volunteers contribute significant time and effort in collecting data; it is therefore important to establish quality control measures that ensure this data is scientifically sound and able to be used.

Following a review of the program in 2012, Parks Victoria has improved Sea Search to make certain baseline quality control objectives are met, and ensure the validity of data.

Quality control improvements include:

- The provision of a range of methods aimed at different skill levels
 - Clear, step-by-step instructions for monitoring methods
 - Regular training and refresher courses for facilitators and participants
 - Producing training videos
 - Having a roving quality control person appointed during difficult level monitoring activities
 - An improved database interface
 - Undertaking annual reviews of the program to ensure objectives are being met
-

The volunteers role in quality control

The more accurate the information you collect, the better it is for helping understand our marine environment, detecting threats and changes, and helping contribute to managing it more effectively. To ensure your contribution to the Sea Search program is meaningful, it is worthwhile referring to the following guidelines.

Quality control guidelines for volunteers:

Read up and familiarise yourself with the methods before the day of a survey. If unsure how to implement any of the methods refer to the relevant video clip, or speak to your ranger.

Take step-by-step instructions with you when you go out into the field, and follow them closely. These are available on the Sea Search website, and from your ranger on the day of an activity.

Make sure the GPS unit you are using is set to the correct format each time you go out, so you are coming back to the same (randomly assigned) quadrat sites each time. Note that Parks Victoria uses the WGS84 format displayed in Degrees, Minutes and Seconds.

Ensure all relevant data has been collected (i.e. datasheets should have no gaps). Check you have recorded a complete set of data before moving to the next quadrat, or the next method.

Have your partner check your data.

Enter data into the spreadsheet/database as soon as possible after the survey has been completed.

Keep up to date on species ID and take ID guides out into the field as necessary. To improve ID skills attend training courses where available and share your knowledge with others. If unsure about a species write a detailed description and take photos so your ranger can seek the advice of experts in marine taxonomy.

If you are unsure about anything ask your ranger.

Equipment overview

All equipment required for undertaking Sea Search monitoring is available from your local ranger. Even if you are familiar with these tools, it is important to refresh yourself and check you are using them properly. Below is an explanation of some of the specific equipment used during Sea Search activities.

Identification guides

Species identification guides come in a number of formats, with different levels of detail. It is recommended to have a range on hand during monitoring activities to accurately identify the species you observe. Your ranger will have a number of guides, suitable to your location, available during each Sea Search activity.

Species identification sheets, including those specifically developed for Sea Search, provide a quick and easy visual reference to the more common species found in our MPAs. Multiple species appear on each side of the sheet, with a photograph, common name, and scientific name provided.

Identification field guides are also useful, usually having one or two species per page, with detailed information such as a photograph, tips for identification, range map, and a paragraph about habits of each species. Due to space restrictions these guides may only cover a broad grouping of plants or animals e.g. Invertebrates or cephalopods (octopus, cuttlefish and squid).

Alternatively, they may cover a wider range of species types, but only within a limited geographic range, such as Port Phillip Bay.

Increasingly, identification guides are being developed as smartphone applications. These have the added benefit over traditional resources of allowing for audio and video content. Good examples of this type of identification guide are Museum Victoria's 'Field Guide to Victorian Fauna', the 'Bunurong Marine National Park Field Guide' (developed by Parks Victoria and Museum Victoria) and the 'Barwon Bluff' app developed by Friends of the Bluff in Barwon Heads. The 'Port Phillip Bay Taxonomic Toolkit' is another great online identification resource worth referring to if you are working in or near that region.

It is important to select guides that are applicable to your local area e.g. Port Phillip Bay, Victoria, or Southern Australia. A guide for Australia's northeast coast species is no use on our temperate southern coast, however range expanding warm temperate species may soon become more common on Victoria's eastern coast, where such a guide may prove more useful.

Below: The intertidal reef identification sheet provided in this manual being used by Sea Search volunteers at Mushroom Reef Marine Sanctuary.



GPS

GPS (Global Positioning System) units communicate with satellites to determine their location on the earth's surface.

A GPS unit is able to accurately record the location of, say, a marine pest or a Fixed Point Photo. This saved location is called a GPS waypoint, and is able to be retrieved at a later date. Waypoints are defined in two dimensions (e.g., longitude and latitude) recorded in degrees, minutes, and seconds (e.g., 38° 29' 29"S, 145°01'09"E). Parks Victoria uses the WGS 84 standard, so ensure when taking or referring to waypoints the GPS unit you use is set to this format.

Digital camera

Sea Search uses digital cameras to visually record various values, assets, threats, and activities in MPAs. This includes recording change over time within a site (1.1 Fixed Point Photos), photographing species that inhabit a site (1.2 Species Library), and recording unusual and potentially invasive species for follow up with experts (as part of 1.3 Sea Search Patrol).

For both habitat types monitored, quadrats are located randomly on the site (encompassing mid and low intertidal reef areas, and the full extent of a seagrass bed) using predetermined GPS waypoints as a guide so as to place quadrats without any bias. These waypoints are available from your local ranger, who is able to assist in this process.

It is important to accurately record your Fixed Point Photo locations, so it can be found again by you or other Sea Searchers. As well as recording the GPS waypoints of each location, use permanent landmarks to help you determine the Fixed Points.

A number of digital cameras are available for Sea Search activities from your local ranger, suitable for use around or even under water. Sea Searchers are able to use their own cameras should they prefer.

Recommended settings describing image size, quality and format are outlined in the appendix. Similarly, naming protocols for naming your Sea Search photographs are also described in the appendix.

Below left: A typical hand-held GPS unit.

Below: A diver photographing a school of Port Jackson Sharks at The Arches Marine Sanctuary.



Sea Search method sheets

Following the introduction to each monitoring method are Sea Search method sheets. These describe, with clear step-by-step instructions, how each monitoring activity is to be undertaken.

These are available on the Sea Search website as standalone documents, and

should be printed out and followed closely during each Sea Search monitoring activity.

Method sheets can be easily identified in this document as they show one of the following symbols in the top right-hand corner of each page:



Callipers

Callipers are a tool used to accurately measure dimensions. They comprise a calibrated scale with a fixed jaw, and another jaw with a pointer, that slides along the scale allowing accurate, to the millimetre measurements to be taken.

If unsure how to correctly use callipers, refer to the instructions included with the equipment, or ask your ranger for assistance.

Quadrats

To collect consistent data, biological sampling requires a standard sampling unit to be used. This ensures comparable samples of consistent size and shape are made across the site, at other locations, and at different times.

The sampling unit Sea Search uses for intertidal reefs and seagrass monitoring is the quadrat. It consists of a square frame (50cm x 50cm). These are either 'open' for using for photo quadrats, or

'closed', which are subdivided into a 7x7 grid of nylon.

Quadrat placement markers are often used when setting up the survey site. These may be set out by the ranger at the start of the excursion who uses the GPS to find the predetermined quadrat positions. These can be any object that can be readily seen and help to ensure that quadrats are placed in the right locations.

Below left: Callipers being used to measure a limpet at Mushroom Reef Marine Sanctuary.

Below: Sea Search volunteer Jamie holding a closed quadrat at left, and an open quadrat at right.





Methods for all habitats

Introduction

The Sea Search monitoring activities in this section can be undertaken in any habitat within a marine protected area.

These methods can be used by community groups that undertake regular monitoring. Alternately, they can be undertaken by schools and other groups wishing to provide a focus or additional activities for their MPA visit. They are easy to learn and carry out, and do not require comprehensive training (though consultation with experts may be required to identify species captured in photographs).

Furthermore, timing and frequency of methods 1.2 [Species Image Library](#), and 1.3 [Sea Search Patrol](#), need not be seasonally restricted – observations and images may be collected opportunistically, at any time throughout the year.

Method 1.1 [Fixed Point Photos](#) are most useful if undertaken seasonally, with volunteers aiming to take photographs at the same time within each season. Each of these 'all habitat' methods can be carried out separately or together, or in conjunction with intertidal reef and seagrass methods.

Habitats that may be of interest and that would be well suited to these methods include beaches, intertidal habitats such as soft sediments, rocky shores, mudflats, mangroves, coastal saltmarshes, and shallow subtidal habitats including rocky reefs and seagrass beds.

All methods can be undertaken from shore. Sea Search Patrols for marine pests, and photographing of subtidal marine species for the Species Image Library can also be done while snorkelling or SCUBA diving.

Below: A fixed point photo recording significant wrack deposition at Ricketts Point Marine Sanctuary.



1.1

Fixed point photos

What are the broad changes in habitats that occur over time within the marine national park or marine sanctuary?

Images of marine protected areas, taken from a fixed location, give a visual record of the park at that point in time. Repeated photos from these same locations over time are a valuable tool for detecting changes in the park, such as habitat area.

Images may illustrate seasonal and long-term variations such as algal extent, extent of seagrass, or the expansion of a mangrove forest. These areas may also change in response to human activity, invasion of exotic species, or even shifts in the climate.

Having this visual information enables managers to assess qualitatively whether habitats within MPAs are stable,

expanding, or contracting, and can therefore help identify severe changes and long term indicators of change.

Ideally, volunteers will undertake this method seasonally, that is 4 times per year. To minimise the effect of seasonal variation from year to year it is preferable that these photographs are taken on roughly the same date each season (e.g. summer photographs should be taken at roughly the same time each year, say within the first two weeks of January). In addition to these seasonal photographs, volunteers are encouraged to photograph significant events, such as wrack deposition, algal blooms, or pollution, as they occur - which may occur outside seasonal dates.



Case study

The application of a fixed point photo series

The Fluker Post Project is a Victorian based initiative that uses fixed point photos to assist land and marine managers in detecting change over time in the environment. Where available they are great to use, assisting volunteers obtain accurate fixed point photos. Where not available, equally good results can be achieved provided volunteers accurately record the location and orientation of each photo point.

See www.flukerpost.com.au for more information.

1.1

Fixed point photos



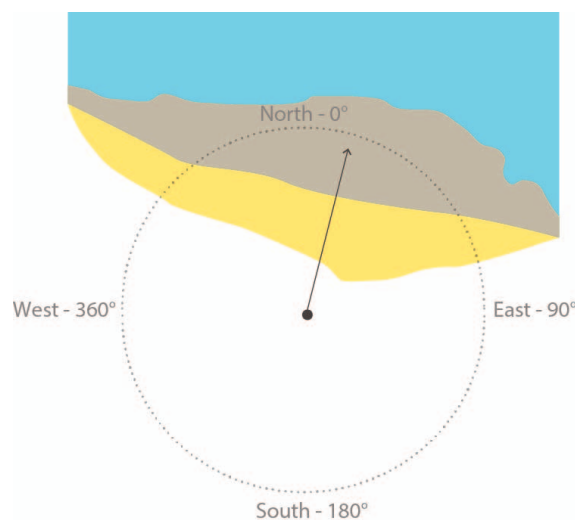
Gear

- Digital camera
- Clipboard and pencil
- Site datasheet
- GPS
- Compass

Survey methods

1. At one or more sites choose a suitable vantage point on or adjacent to the shore and take a GPS recording of your position. **This is your fixed point that you return to each time you take photos at the site.** Note the GPS waypoints on your site datasheet.
2. Decide on the main subject and field of view such that details of interest will be clearly seen in photos on this and future occasions.
3. Take a photograph of the subject, experimenting with the zoom and other relevant camera settings necessary to achieve clear and detailed photographs. Record these optimum photo settings on your site datasheet.
4. Record the direction of the middle of your photo as a compass bearing (degrees from North where North is 0°) on your site datasheet so you know which direction to take the photo the next time you visit.

Tip: minimise the amount of sky in your photo as this is not of interest.



Return trips

1. Return to the exact same spot on a regular basis and use the same methods, exact compass bearings, and camera settings as used previously.



Photo files and datasheets

1. Download and clearly name photo(s) in .jpg format with location, photo number and date. For example, the first image you take from Barwon Bluff, on the 13th of April 2012, would be PV_BAR_2012_04_13_001.
2. Location names and their labelling codes are found in Appendix 1.
3. Upload data to APP/Online database or forward image files on USB and datasheets to the Park Ranger for filing and to look for changes through time.

Notes

- Include permanent landmarks in your photos if possible.
- Refer to these photos each time to make sure you take your next photo from the same place each time.
- Multiple sites may be used for larger marine national parks and marine sanctuaries.

1.2

Species image library

What are the types of animals and plants that are found within the marine protected area?
Are there any unusual species, such as marine pests or native range-expanders?

This method involves capturing images of all life forms in marine protected areas using digital cameras. Marine protected areas contain an abundance of plant and animal species, some of which are well known, but many of which are not. In order to better understand and conserve the biodiversity within protected areas, more information is needed. Your images will help document the diversity within parks and can assist in developing identification guides.

Photos of previously unknown species at a location may reflect the limited number of people that have explored the area, or may indicate that a new species has arrived. This may be important information for park management.

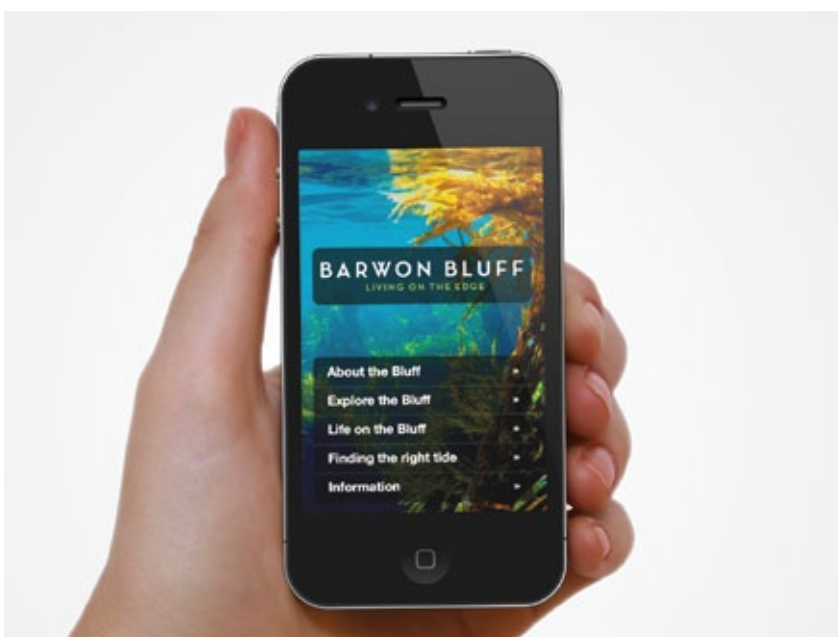
Volunteers are encouraged to log sightings of unusual and range expanding species on the interactive 'Redmap' website. Redmap stands for Range Extension Database and Mapping project. This project invites Australians to share sightings of marine species that are 'uncommon' to their local seas. Over time, Redmap will use this 'citizen science' data to map which Australian marine species may be extending their distribution range in response to changes in the marine environment such as ocean warming.

Photos of marine life can show others the unique marine life inhabiting Victoria's cool water habitats and through raising awareness can assist in their protection.

The introduction of exotic marine pests into Australian waters is a major environmental issue. Once established, marine pests are extremely difficult to eradicate so government strategies for dealing with pest species are largely focused on prevention, rather than control. Early detection of pest incursions however can assist with containment in certain circumstances, particularly when densities are low. Sea Search participants may be the first to raise the alarm if new pest species are appearing inside marine protected areas.

In addition to unwelcome introduced marine pests, marine species common in warmer waters along the east coast of Australia are being observed further south, most likely in response to climate change-related ocean warming and intensification of the East Australian Current (EAC).

Sea Search participants may be the first to record the presence of native species outside their previous natural range. Regular monitoring over time will help determine if their distribution is within the range of natural variability or indicative of a more recent geographic expansion. It is anticipated that in addition to Sea Search records, this information will be added to the database of the Redmap national program which maps changes in species distributions in response to climate change.



Case study

How a species library can develop

Friends of the Bluff are a community group associated with Barwon Heads, and the Barwon Bluff Marine Sanctuary. They have compiled an extensive species library over the years, from which they have been able to produce three guide booklets – Life on the Edge (intertidal marine life); Plants that Clothe the Bluff, and Birds of the Bluff .

Friends of the Bluff have now developed a smartphone application. This interactive app uses a smartphone's inbuilt GPS to lead you around the Barwon Bluff and help you to identify, understand and appreciate this unique environment and the plants and animals that live there. Their extensive species library was integral to realising this initiative.

1.2

Species image library



Gear

- Digital camera
- Note book and pencil
- Field identification guides

Where

Anywhere in your marine national park or marine sanctuary.

Timing

For intertidal species go during predicted low tide. For subtidal species snorkel at mid-high tide.

Survey methods

1. Take photos of any animal or plant that is of particular interest to you – even if you don't know what it is. If your ranger requires photos of particular species at your location they may provide you with a list of fish, invertebrates, algae and seagrass species as a guide of what types of species to look for.
2. Take multiple photos from various angles as this helps with the identification (e.g. top, side, and underside).
3. Identify the subject in your photo using field identification guides. You can use scientific names or common ones (e.g. *Turbo undulatus* or turban shell).
4. If you are unsure of the identity of your specimen, work with the Sea Search group and Parks Victoria ranger to positively identify the specimen using identification guides and books.
5. If you cannot identify an animal or plant in the field write a description to go with your picture. Where further confirmation of species identification is required, the ranger will follow up with experts.
6. Make notes of the location, date, species name and the person taking the photo.

Marine pests and native range expanders

Most marine pests and native range expanders will be found in the shallow subtidal so the best chance of spotting them is by snorkelling. Walks during low tide may also pick up these types of species especially lower on the shore and in rock pools.

Alert

If you see what you believe is a marine pest or native range expander in addition to a photo, write a description and record exact location (and any habitat information) – **DON'T REMOVE** – and advise a Parks Victoria ranger as soon as possible.

Photo files

1. Download and clearly name photos in .jpg format with location, habitat, date and species details. For example, an image from Barwon Bluff of *Turbo undulatus* (Turban shell), on the rocky intertidal, on the 13th of April 2012, would be PV_BAR_2012_04_13_Tund_rockyint.
2. Location names and their labelling codes are found in Appendix 1.
3. Upload image files to the APP/Online database, or forward image files on a USB and any accompanying information onto the Park Ranger for filing and any necessary follow up with experts.

1.3

Sea Search patrol

What are the types of human activities and uses occurring within a marine protected area?

Are there any threats, such as pollution, litter, disturbance, affecting the marine protected area?

Are there changes in timing of reproduction by resident marine species?

Coastal and marine habitats are threatened by a range of human activities, marine pests, the arrival and establishment of warmer-water species, pollution and litter. Even in areas where regulations prohibit fishing, collection and disturbance, these activities may still occur. Marine protected areas can have high visitor numbers with people engaged in a range of activities, depending on the location and ease of access.

Gathering information on numbers of people within the park and what they are doing can help managers identify whether particular types of activities may be having a negative effect on resident plants and animals that could be addressed by changing management. For example, observing and reporting disturbance of wildlife by dogs, which particularly impacts on shorebirds and seabirds (e.g. the Hooded Plover), can lead to strategies to limit dog presence in the park.

Sea Search participants can make a valuable contribution to the conservation of marine protected areas through regular Sea Search surveillance patrols. Information recorded by observers can help identify potential threats at an early stage so that managers can take quick action.

By being present you may also witness biological events (e.g. evidence of reproduction such as egg capsules, natural peaks in abundance) that tell us more about marine species and ecosystems.



Case study

Observation leads to discovery

The first report of a previously unknown invasive marine species in Victoria was made by community volunteers at the Point Cook Marine Sanctuary. The unusual looking marine algae was observed and photographed, and the location of the plants recorded.

Under permit a sample of the algae was collected and provided to experts for analysis and genetic testing, leading to an identification of *Grateloupia turuturu*. This species, which is native to north east Asia, has the potential to outcompete native species in Port Phillip Bay.

1.3

Sea Search patrol

SEA SEARCH METHODS		
LEVEL OF DIFFICULTY		
EASY	MODERATE	HARD

Gear

- Clipboard and pencil
- Data sheets
- Digital camera (waterproof for snorkelling)
- Checklist of native marine migrants from the redmap website
- Feral and In Peril Reefwatch VIC guide (available online via Atlas of Living Australia)

Where

Across the entire marine national park or marine sanctuary, or at multiple sites within (make sure to record where they are for future visits). Each time you visit try and cover a similar area.

Timing

The best time to do these surveys especially for human use information includes weekends, public holidays, school holidays, and good weather (e.g. sunny days). If possible try to do your survey at the same time of day (between 1pm and 3pm is best) and or same low tide period as previous surveys.

Survey methods

1. Do a walk or snorkel (about 30-60 minutes) covering as much of the area as possible.
2. Fill in the datasheet for each of the 3 impact types below and repeat each time you visit.
3. Take photos of examples of pollution, litter, or unknown species with your digital camera.

Humans, dogs and watercraft

1. Do surveys when visibility is good (e.g. not pouring with rain) and note the time and tidal height – ideally making observations at around the same (low) tide height each time.
2. On the datasheet record the activity of humans, dog presence and watercraft type including the approximate number of humans engaging in particular activities, e.g. illegal fishing, fossicking, walking, surfing. If you observe illegal fishing, take a photo and call 13FISH.

Pollution and litter

1. Do surveys when visibility is good (e.g. not pouring with rain) and note the time and tidal height – ideally making observations at around the same (low) tide height each time.
2. On the datasheet record any signs of pollution such as litter, chemicals, or oil within the MPA. If you see obvious signs of chemicals, oil or other substances in the vicinity contact Parks Victoria on 13 1963 or EPA on 1300 372 842.
3. Pollution and litter may also be noticed from a vantage point near the MPA if you walk by more frequently you can make records of this.



Biological events

Biological events can include sightings such as seals or dolphins offshore, lots of snail eggs, sea jellies (jelly fish) in the water or washed up on the beach, flowering seagrasses and mangroves, or paper nautilus shells.

1. If you see something of biological interest then note these down and take a photo if you can.

Finishing up

1. Check data sheets are complete.
2. Pack up gear.
3. Upload your data onto the APP/Online database – this should be entered as soon as possible.
Alternatively, collate your data sheets and give them to the ranger who either enter the data or provide copies to volunteers for entering onto the database

Photo files

1. Download and clearly name photos in .jpg format with location, habitat, and date.
For example, an image from Barwon Bluff, on the rocky intertidal, on the 13th of April 2012, would be PV_BAR_2012_04_13_rockyint.
2. Location names and their labelling codes are found in Appendix 1
3. Upload image files to the APP/Online database or forward with any accompanying information onto the Park Ranger for filing and any necessary follow up.



Intertidal reef monitoring

Introduction

Intertidal reefs are the rocky areas between high and low tide, found in many of Victoria's marine protected areas.

Intertidal reefs can be made up of a variety of rock types and forms, upon which algae can attach, and where invertebrates may flourish. Reefs may be continuous sections of rock, or occur as areas covered by boulders or cobbles.

Exposed to air at low tide and covered by seawater at high tide, intertidal reefs support diverse and unique combinations of plants and animals that have evolved to survive in this dynamic environment. Birds make the most of the low tide to forage, while with the incoming tide nearby fish move onto the now submerged reef to feed and shelter.

Intertidal reefs in Victoria's marine protected areas are home to numerous forms of brown, red and green algae; they cover the intertidal zone and provide habitats for many marine species as well as providing a source of food and nutrients.

Along with algae, some invertebrate animals such as mussels, barnacles, calcareous tube-building worms and ascidians (sea squirts) can also provide important habitat for other organisms. They trap water, provide microhabitats, and can repel or encourage other reef species to settle.

More species of algae grow at the lower edge of intertidal reefs than higher up the slope, as these areas may get too

hot and dry for most algae. Invertebrate animals that form dense covers can live higher up on the reef platform because they are protected from drying out by their waterproof shells, plates, or tubes.

Intertidal reefs are a great place for people to discover the fascinating marine life inhabiting the land-sea interface, but their popularity and exposure to human impacts can threaten the biodiversity of rocky shores. Human activities such as collection, fishing, trampling and rock turning can remove and injure animals and destroy the algal habitat on which they depend. Pollution, marine pests and climate change impacts (sea level rise, increased temperatures and altered seawater acidity) also threaten these habitats and organisms.

Regular Sea Search monitoring provides data that increases understanding of the natural variability of intertidal populations, provides valuable indications of change, and helps inform management decisions.

Field work should be done when low tide is predicted at 0.4 m or lower (0.2 or lower west of Apollo Bay). Participants should be on site around 1.5 - 2 hours before low tide. Ideally surveys should be completed before, or as, the tide comes in with participants leaving the reef well before sites are covered with water.



Site setup

Marine plants and animals are broadly distributed on intertidal reefs in 3 stratified 'zones'.

These zones loosely correspond with the duration for which they are exposed and covered during each tidal cycle, and by species interactions causing a dominance of particular species. The lower intertidal zone is only exposed to air on very low tides while the mid intertidal zone is regularly exposed and submerged by average tides. The upper intertidal zone is only covered by very high tides, but on shores exposed to large swells it is also influenced by waves and sea spray – meaning that the intertidal region can extend above the high tide line. While these general patterns are best observed on sloping rock platforms, in many cases these zones will be patchy and determined by the relative height of the reef at different locations.

Methods for Sea Search surveys are done in the mid intertidal zone and lower intertidal zone. In general, the mid intertidal is dominated by mussels, limpets, and snails, while the lower intertidal zone is dominated by larger brown algae, and invertebrate inhabitants such as *Cunjevoi*.

Surveys of intertidal areas rely on the use of quadrats to sample areas and make comparisons between sites. The locations of quadrats have been predetermined by Parks Victoria rangers and scientists. The location of each quadrat position is recorded using GPS way points.

New Sea Search surveys will require quadrat locations to be determined by Parks Victoria staff prior to commencing.

Below: Tubeworms are a common intertidal species and can sometimes form significant bands such as those seen on this reef at Ricketts Point Marine Sanctuary.



2.1

Cover quadrats - algae and invertebrates

How does the cover of algae (especially the habitat forming species *Hormosira banksii*) vary in the marine protected area over time?

How does the cover of aggregating invertebrates (e.g. mussels, worms and barnacles) vary in the marine protected area over time?

Sea Search monitoring of intertidal algae and animal cover can help keep track of the health of rocky reef habitats. If changes in species composition and cover are determined to be beyond the limits of natural variation, further research and management intervention may be required.



Photo: Chris Neufeld

Did you know

How to mate when you're stuck to a rock

Barnacles are sessile in their adult form, firmly cemented to a suitable substrate which requires them to catch their food from the water column with their feathery appendages. However before settling down they spend their youthful larval stages as free-swimming plankton. So why do adult barnacles cluster together on the rocky shore?

Barnacles need to fertilise each other internally, so minimising the distance between a potential mate is essential. Through detecting adults of their own species through chemical markers, mobile larvae seek out and affix themselves to existing colonies of barnacles, enabling them to mate. Hence the clusters of barnacles we see.

To further enhance breeding success barnacles have evolved the largest penis in proportion to body size in the animal world – up to 8 times its own body length! The enormous appendage is therefore able to blindly reach across the colony and deposit sperm in any receptive mates available.

2.1

Cover quadrats algae and invertebrates

SEA SEARCH METHODS
LEVEL OF DIFFICULTY

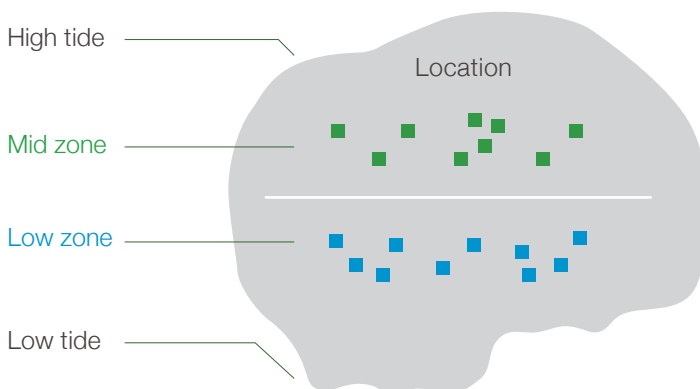
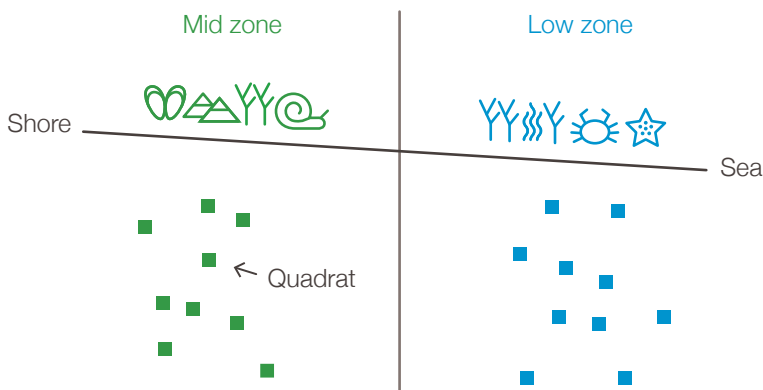
EASY MODERATE HARD

Gear

- GPS and quadrat placement map
- Quadrat placement markers
- Quadrats – 50cm x 50cm (use gridded quadrat for field sampling or open quadrat for photo sampling). Two per 2-4 people.
- Site information sheet
- Photo labeller OR Printable labels for photo quadrats – choose the labels with relevant location code
- Clipboard and pencil
- GPS
- Digital camera. One per 2-4 people.

Setup

- At each site monitoring is done in 2 zones (mid and low).
- The ranger will have the quadrat placements saved into a GPS unit and drawn on a map.
- Using the GPS unit and a map of the location the ranger will place numbered quadrat placement markers with each zone.
- Volunteer pairs or groups will be assigned a set of quadrats to photograph/sample (e.g. group 1 may sample quadrats 1-5, group 2 may sample quadrats 6-10).





Survey methods

1. Select a survey date – ensuring that there is a low tide of 0.4 m or less. Arrive at the rock platform 1.5 - 2 hours before low tide.
2. The ranger will assist in locating the intertidal zones and quadrat placement in which the surveys will be done using GPS coordinates, landmarks and photo cards.
3. At each site, fill in the site information sheet with general details such as date, location, and name of participants.
4. Record the number of the quadrat you are sampling on the data sheet.
5. Collect data/take photo using instructions below (photos or field data).
6. After finishing the quadrats in the mid zone, move down to the lower intertidal zone and repeat this process until all the quadrats are photographed/sampled.
7. During your surveys, take photos of unknown sessile animals or algae that occur around the general site area for future identification using field guides/expert assistance.

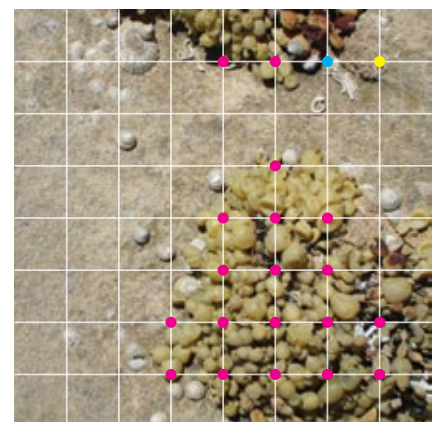
Photos

1. Place a photo label inside the top left corner of the quadrat (being careful not to obstruct plants/animals). Use [Appendix 2: Photo quadrat labels protocol](#) to produce a set of labels for your MPA.
2. Use a digital camera to take photos of the quadrat from directly above (where possible) while also minimising shading in the frame. On sunny days, try to avoid glare.
3. Ensure that the edges of the quadrat can be seen in the frame and that the image is in focus.

Field data

1. If collecting the cover data in the field count how many of the intercept points (where the string crosses – diagram at **right**) match with each cover species listed on your data sheet (add others if found) and fill in the number on the data sheet. Images of any new or interesting species should be forwarded (as .jpeg) to your Parks Victoria ranger who will store them for reference or further follow up with experts where necessary.
2. Start at the top left hand corner and record the cover under each intercept point working to the right hand side of the quadrat, then move down directly below your last point to the next row moving left and so on until you have checked all 49 intercept points.
 - a. Always count what is directly under the intercept not next to it, pretend you are using a skewer to line it up.
 - b. Check your counts don't add up to over 49 points one way to do this if there is different algae or aggregating invertebrates under all points count one species then write "rest" in the spot for the other species/substrate (e.g. rock/sand) so you don't miscount.

Quadrat 01



- Pink dots are for *Hormosira banksii* (19)
- Blue dot is for *Galeolaria caespitosa* (1)
- Yellow dot is for *Coralline Turf* (1)



Quality control

1. At least one person in the volunteer group should be identified as the quality control person (this person is likely experienced at the method, and familiar with the species).
2. This person should spot check between groups to make sure everyone is sampling and recording correctly (using the quality control checklist) e.g. point intercept counts are accurate, quadrat isn't in rockpool, photos are clear and in focus.
3. One way of ensuring accuracy is for more than one person to count the species and intercept points in each quadrat (from the same position) to make sure they both get the same count.
4. Either the quality control person or another group should check that all the information on the data sheet has been filled in before the next quadrat is sampled.

Finishing up

1. Check your cover data sheets are complete, collate and give them to the ranger who either enter the data or provide copies to the volunteers for entering onto the Sea Search database.
2. Pack up gear.

Photo files

1. Download and clearly name photos as .jpg with location, site and date details For example, an image from Barwon Bluff on the 13th of April 2012, mid intertidal zone, quadrat 4 would be PV_BAR_2012_04_13_BB_MQ4.
2. Location codes for labels are found in [Appendix 1: Photograph naming protocols](#).
3. Forward image files on a USB onto the Park Ranger so they can be stored and talk with them about images you can help analyse.

2.2

Counting snails and other mobile creatures

How does the abundance of some key species of marine invertebrates change in the marine protected area over time?

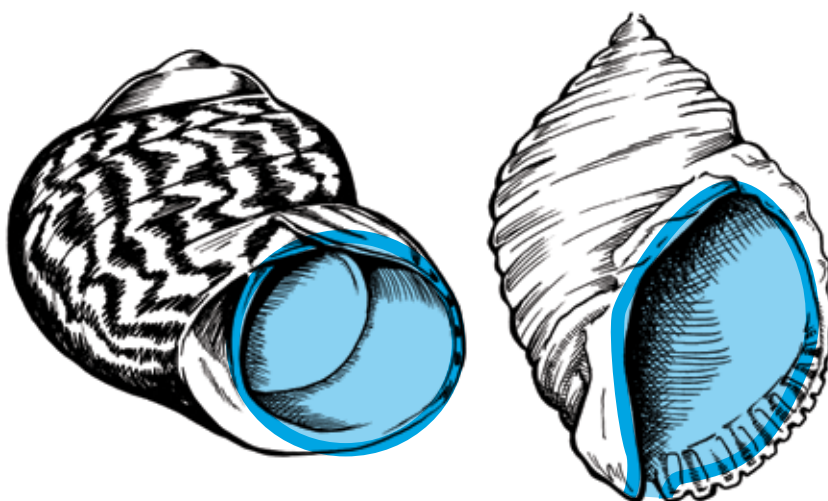
Intertidal reefs in Victoria's marine protected areas are home to unique cool-water species of mobile marine invertebrates such as marine snails, crabs, and sea stars. These mobile marine invertebrates are often the most conspicuous animals on intertidal reefs and can be found sheltering in algae and crevices, weathering the waves on rocks, and submerging themselves in rock pools.

Sea Search monitoring of common invertebrate species will enable managers to keep track of the health of rocky reef habitats. The abundance of mobile invertebrates may naturally rise and fall in response to pressures such as food availability, predation, or disturbance by storms. Monitoring over a number of years and seasons will

help determine if changes occurring in populations inside marine protected areas are within normal limits, or if they indicate that human impacts, such as fossicking and trampling of habitat, may be occurring. Monitoring may also show that an improvement or recovery is taking place. If changes in species populations are determined to be beyond the limits of natural variation, further research and management intervention may be initiated.

Surveys on the reef are done by counting the abundance of certain common snail and limpet species in 50 cm x 50 cm quadrats at sites within the marine protected area.

This activity should ONLY be done in conjunction with [2.1 Cover Quadrats](#); ensuring all quadrats are completed for that method, as this is the highest priority data.



Did you know

Salad bowls and gravy boats

By comparing the openings of different marine snail shells, you can see if they are carnivorous or herbivorous. If the opening is round and looks like a salad bowl, it is likely to be a herbivore. If the opening is long and has a small groove like a gravy boat, it is a carnivore.

2.2

Counting snails and other mobile creatures

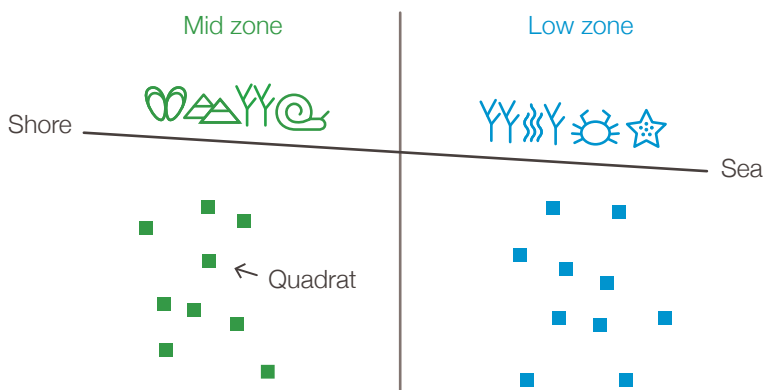


Gear

- GPS and quadrat placement map
- Quadrat placement markers
- Quadrat – 50 cm x 50 cm open and marked on edges to show 25cm (one quadrat for 2-4 people)
- Intertidal Reef Field Identification Sheet
- Clip board and pencil
- Digital camera
- Quadrat Data Sheet

Setup

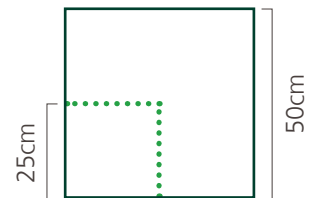
- At each site monitoring is done in 2 zones (mid and low).
- The ranger will have the quadrat placements saved into a GPS unit and drawn on a map.
- Using the GPS unit and a map of the location the ranger will place numbered quadrat placement markers with each zone.
- Volunteer pairs or groups will be assigned a set of quadrats to sample (e.g. group 1 may sample quadrats 1-5, group 2 may sample quadrats 6-10).





Survey methods

1. Select a survey date – ensuring that there is a low tide of 0.4 m or less. Arrive at the rock platform 1.5 - 2 hours before low tide.
2. The ranger will assist in locating the intertidal zones and quadrat placement in which the surveys will be done using GPS coordinates and landmarks.
3. At each site, fill in the site information sheet with general details such as date, location, and name of participants.
4. Record the number of the quadrat you are sampling on the data sheet.
5. Identify and count the number of animals in the quadrat as they appear on the data sheet¹ and record this value.
 - Take photos of unknown animals for future identification using field identification books or expert assistance.
 - Do not count very small animals less than 4 mm shell length/height. Small animals are difficult to identify and are likely to be recent arrivals, therefore it is more accurate to count older individuals to get an estimate of population abundance.
6. If there are very high numbers of one species (> 100 per quadrat), only count them in one quarter of the quadrat (i.e. 25 x 25 cm area, see diagram at right). **Multiply this count by four and enter this number in the datasheet.**
7. After finishing the quadrats in the mid zone, move down to the lower intertidal zone and repeat this process until all the quadrats are sampled.



Quality control

1. At least one person in the volunteer group should be identified as the quality control person (this person is likely experienced at the method, and familiar with the species).
2. This person should spot check between groups to make sure everyone is sampling and recording correctly (using the quality control checklist).
3. One way of ensuring accuracy is for more than one person to count the species in each quadrat to make sure they both get the same count.
4. Either the quality control person or another group should check that all the information on the data sheet has been filled in before the next quadrat is sampled.

Finishing up

1. Check your cover data sheets are complete, collate and give to your Parks Victoria ranger who will either enter the data or provide copies to the volunteers for entering onto an excel spreadsheet.
2. Pack up gear.
3. Collate your data sheets and give them to the ranger who either enter the data or provide copies to the volunteers for entering onto an excel spreadsheet.

Photo files

1. Download and clearly name photos as .jpg with location, site and date details For example, an image of an unknown species from Barwon Bluff on the 13th of April 2012, mid intertidal zone, quadrat 4 would be PV_BAR_2012_04_13_MQ4_un.
2. Location codes for labels are found in [Appendix 1: Photograph naming protocols](#).
3. Forward image files (on USB as .jpeg) onto the Park Ranger so they can assist you with identifications or follow up with experts where necessary.

¹ Volunteers survey specific species of marine snails and limpets commonly found in Victoria. If groups wish to select additional mobile invertebrates for monitoring they can be included on the data sheet and should be recorded in all future surveys. Additional species should be easy to identify, for example sea stars (e.g. Five-armed Cushion Star, *Parvulastra exigua* and the Eight-armed Cushion Star, *Meridiastra calcar*). Note that adding extra species to your data sheet is optional.

2.3

Catch per unit effort – snail and limpet sizes

What is the size range of common species of gastropods inside marine protected areas, and how does this vary over time?

Are the abundances and sizes of targeted and non-targeted species different?

Marine snails and limpets belong to a group of invertebrate animals known as gastropods (often referred to as marine snails). Gastropods are important in food webs, acting as prey for larger animals such as birds, fish and octopus, and influencing the types and amount of algae growing on rocky shores. Many species are herbivores, while others are predators or scavengers.

Because they move slowly most gastropods are easy to spot and capture, with some species taken as bait, for human consumption, or by shell collectors. Studies in Australia and overseas have shown that populations can be severely depleted by human collection and species may be permanently lost from an area. Loss of key gastropod species can have flow on effects on the intertidal reef leading to changes in the abundance or cover of other species.

In addition to being protected inside the boundaries of marine national parks and marine sanctuaries, all other gastropod such as abalone, snails, limpets and periwinkles are protected in the intertidal zone across Victoria, down to 2m depth. Collection of both live animals and shells is prohibited inside marine protected areas.

The abundance and sizes of intertidal gastropods may naturally vary through time and between places depending on the physical environment, and understanding this natural variability can help identify impacts that may occur. Comparing the size and abundance of gastropod species that are targeted (i.e. they are a preferred species for collection) to non-targeted species can help determine if gastropod populations are being impacted by human collection. If targeted snail species are found to be markedly smaller than previously and the control species at the same locations it may indicate poaching is taking place.

Ten minute searches are done for separate species of common gastropods in the intertidal zone of marine protected areas. This method focuses on gastropods that are known to be impacted by human collection, and compares them to 'control' (non-targeted) gastropods within the marine protected area. This gives us an estimate of how common a species is on the reef (as less common species will take longer to find than common species). Size measurements provide information about natural fluctuations in populations and a reference against which potential impacts can be measured.

Please note that 2.3 Catch per unit effort monitoring should only be undertaken following measures of cover and invertebrate abundance (2.1 and 2.2) as these provide the highest priority data.



Did you know

Limpet locomotion

Limpets are active foragers; when covered by water they move around feeding on the algae that grows on the surface of the rocks. To avoid desiccation on the exposed rock platform at low tide, limpets form a seal between their shell and the rock.

They can return to the exact same spot, over time wearing away a depression in the rock, known as a scar, which helps ensure a very tight seal.

2.3

Catch per unit effort – snail and limpet sizes

SEA SEARCH METHODS
 LEVEL OF DIFFICULTY
 📄

EASY

MODERATE

HARD

Below is a list of intertidal snails and limpet species for timed searches and sizes. You must match a target species to its control (match the colour). For example you might match Warrener *Turbo undulatus* to Stripe-mouth Conniwink *Bembicium nanum/melastomum*.

Targeted by humans		Min. size	Not commonly targeted 'control species'		Min. size
Limpet	<i>Cellana tramoserica</i>	14mm	False Limpet	<i>Siphonaria diemenensis/zelandica</i>	4mm
Top Shell	<i>Austrocochlea constricta/porcata*</i>	14mm	Striped-mouth Conniwink	<i>Bembicium nanum/melastomum*</i>	8mm
Warrener	<i>Lunella (Turbo) undulata</i>	4mm			
Black Nerite	<i>Nerita atramentosa</i>	4mm			
Dog Winkle	<i>Dicathais orbita</i>	4mm	Lineated Cominella	<i>Cominella lineolata</i>	4mm
			Wine-mouthed Lepsiella	<i>Lepsiella vinosa</i>	4mm

**Austrocochlea* and *Bembicium* are represented by different species on the open coast than in the north of the bays. On the coast, *A. constricta* and *B. nanum* are more abundant, while bays tend to have more *A. porcata* and *B. melastomum*. Note that there are also other species of these two genera so use your identification books/sheets to check if unsure.

Site setup

Work within the general sampling area as per rocky intertidal methods 2.1 and 2.2 (it is not necessary to separate between zones, use the whole location).

When and where

Catch per unit effort can be done at the same time as cover quadrats (2.1) and within the same location (so long as you are not disturbing other volunteers collecting cover quadrat data at the same time). The best way to do this is to have most of the volunteer team focusing on cover quadrats (2.1) and one pair can take a break from cover sampling for ten minutes to record one species. They then return to cover quadrat sampling and another pair measure the control species and so on. Unless there is a particularly large team of volunteers it won't be possible to do all three rocky shore methods on the same occasion.

Gear

- Watch for recording the time x 1 per pair of searchers
- Callipers (for measuring shell heights and lengths)
- Clip board and pencil
- Data sheet with table 2.3
- Map or aerial photo of the intertidal reef
- How to measure sheet
- ID sheets
- GPS (optional)



Survey methods

1. At each site, fill in the site information sheet with details of date, time, weather, participants etc.
2. Species occupy different zones or heights on shore – have a look around first to see where species live and search in those zones (not all species will be found at all locations).
3. From Table 2.3, establish which species occur at your location.
4. For each targeted species you choose to measure you must choose a control species (matched by colour in Table 2.3) to measure (i.e. if you choose *Cellana tramoserica* you must choose one of *Siphonaria diemenensis* or *Siphonaria zelandica* – depending on which is found at your site).
5. Work in pairs, if you have done this survey many times you may feel comfortable doing it solo.
6. In pairs – one person searches and measures the snails/limpets (check the minimum size for which you record in table) while the other records and keeps track of time.
7. One species should be focused on for the 10 minute search period – you stop if you either reach 100 measurements or 10 minutes (this gives us a Catch Per Unit Effort).
8. Sizes – measure the shell heights or lengths of up to 100 individuals of each species using vernier callipers (see diagram below for how to measure).
9. Only measure snails/limpets bigger than 4 mm, for *Cellana* and *Austrocochlea* only measure those bigger than 14 mm, for *Bembicium* only measure snails bigger than 8mm (see table).

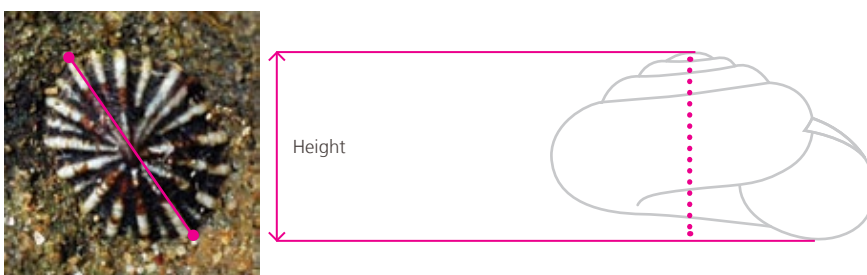
Finishing up

1. Check data sheets are complete.
2. Pack up gear.
3. Collate your data sheets and give them to the ranger who either enter the data or provide copies to the volunteers for entering onto an excel spreadsheet.

How to measure

Measure limpets over the top of their shell while leaving them attached over the longest part as indicated by the pink line on the below photo (Figure 2.3). For shells such as whelks and periwinkles you measure from each tip of its internal whorl (Figure 2.3). The illustration on the far RHS shows how you measure a snail that doesn't have its spire in a straight line. If present (such as in whelks) the callipers should stop at the siphonal groove (not shown).

Figure 2.3







Seagrass monitoring

Introduction

Seagrasses are marine flowering plants that can form extensive beds which support a wide diversity of animals.

Most seagrass species are found in bays and inlets in sheltered conditions, but some species are found on open rocky coasts.

Seagrass species commonly encountered in the intertidal and shallow subtidal zones in Victoria include *Zostera muelleri* (Eelgrass - intertidal), *Z. nigricaulis* (Eelgrass- subtidal), *Amphibolis antarctica* (Wire Weed or Sea Nymph), *Halophila australis* (Paddle Weed), and only in Corner Inlet *Posidonia australis* (Broad-leaf Seagrass).

Seagrasses play a critical role in providing habitat for a wide range of species including many fish, a diverse range of invertebrates, as well as being an important feeding area for birds. Seagrasses play a key role in binding soft sediments and preventing coastal erosion. Many commercial and

recreational fisheries depend on healthy seagrass meadows because they are important nursery areas for young fish. They also play a role in nutrient cycling, producing oxygen and assimilating carbon from the atmosphere.

Throughout the world seagrass meadows are in decline, with implications for biodiversity and fisheries. Water quality is vital to the health of seagrasses and the many species of fish, birds, crustaceans and other invertebrates that depend upon them. Some of the threats to seagrass beds include suspended sediments and nutrients originating from the land and sea, coastal development, dredging, and physical damage from boat anchors, propellers or trampling. Marine pests, climate change, and overfishing also threaten seagrass habitats and the animals and plants that live within them.

Below: Seagrass habitat (*Amphibolis antarctica*) within Bunurong Marine National Park.



Seagrass monitoring methods

There are two quantitative methods the Sea Search program uses to assess seagrass in Victoria's marine protected areas. These assess:

- i. the condition of a seagrass bed as a whole (3.1 Quantifying Seagrass Condition – Rapid and Detailed).
- ii. the size, extent, and edges of the seagrass bed (3.2 Seagrass Boundary Monitoring).

Seagrass methods work together at assessing any changes in the seagrass general site health (e.g. increases in epiphytic algae growth, changes in cover, abundance and density), and whether the seagrass bed is expanding, contracting, or moving.

Participants wade, snorkel, or dive over intertidal and shallow subtidal seagrass beds and use a combination of measures and observational assessments to assess seagrass health. Participants score seagrass density, epiphyte load, measure canopy height, count and identify animals. Any reproductive structures such as flowers and seeds are noted.

Ideally sites should be monitored for condition seasonally. This is because plant growth and cover can vary dramatically between cool months and hot summer conditions. To minimise the effect of seasonal variation from year to year, it is preferable that monitoring is undertaken on roughly the same date each season/year (e.g. summer monitoring should be undertaken at roughly the same time each year, say within the first two weeks of January).

Boundary monitoring should be undertaken at least annually to be able to detect major changes that occur in the overall habitat extent.

Identifying and establishing sites, including the installation of semi-permanent markers and labels, is the responsibility of the park ranger and can only be carried out under permit. Sites of representative habitat are identified by Parks Victoria staff in each study area based on scientific advice, local knowledge and the size of the seagrass meadow inside the reserve.

Seagrass methods must take into account the size of the seagrass bed being monitored, with each site classified as either small or large. The measurements collected are essentially the same, but the site setup and configuration of sampling units within the sites differs.

Seagrasses are sensitive, fragile plants that are damaged by trampling. Because of their inaccessibility and vulnerability to disturbance, some seagrass meadows may not be suitable Sea Search sites.



Case study

Seagrass monitoring in Corner Inlet

The Corner Inlet Seagrass Monitoring Project commenced in 2005, focusing on the extensive Broad Leaf Seagrass beds of Corner Inlet Marine National Park in South Gippsland. These seagrass beds underpin a wetland of international importance providing critical feeding areas for migratory shorebirds. Like other seagrass habitats they also play an important role as nursery areas for many species of fish, including a number of commercial species such as King George Whiting.

For a number of years there have been concerns that the seagrass in the area was under pressure from declining water quality entering the inlet from the

surrounding catchment. This project, involving more than 50 volunteers, has established 11 long-term monitoring sites to look at changes in the extent and quality of seagrass. The project has completed a snapshot survey across the entire inlet and detected previously unobserved localised changes, with data being fed back to the catchment management authority and informing ongoing management decisions. Additionally, it has very effectively raised awareness of seagrass habitats and volunteering in the local community.

See the Corner Inlet Seagrass Monitoring Project on Facebook for more.

3.1 and 3.2

Quantifying seagrass condition

How does seagrass condition (cover, canopy height, epiphyte load) vary over time inside the marine protected area? What types of animals are found in seagrass beds, and how do the types and abundances of these animals vary over time?

Can indicators of seagrass reproduction be seen, and at what time of year do they appear? Is this consistent from year to year?

Seagrass density, along with canopy height, is an important measure of habitat health. Dense stands of healthy seagrass provide different habitat values to sparse or patchy seagrass. In addition to supporting biological diversity, dense seagrass is more effective at slowing currents than sparse meadows, making it a more effective buffer against tides and waves. We therefore measure both shoot numbers and length to get a picture of the habitat that is provided by the seagrass.

Algae commonly found growing on seagrass leaves are known as 'epiphytes' or 'epiphytic algae'. Epiphytes are naturally occurring and provide food for a range of grazers, such as marine snails. Increased nutrients in the surrounding water from human sources, such as agriculture and sewage, may increase the growth of epiphytes beyond naturally-occurring levels, and may favour certain types of nutrient-loving epiphytes. An overabundance of epiphytes can impair and kill seagrass through smothering and blocking sunlight to leaves.

Many species of fish, crustaceans, bivalves, gastropods, and worms live on, amongst, and below seagrass shoots. Recording the animals living in the seagrass provides useful information about the types and abundances of seagrass inhabitants, and improves our understanding of the biodiversity protected in marine protected areas.

The Rapid and Detailed methods answer similar questions but with different degrees of confidence e.g. the rapid method (moderate difficulty) provides a snapshot of the condition and may alert us to large scale changes such as loss of seagrass and new marine pest species. The detailed condition (hard) measures seagrass condition explicitly so we can accurately determine percentage cover which in turn affects habitat structure.

The hard methods should only be undertaken following completion of their respective moderate methods; data collected in hard methods builds on that collected in moderate methods, rather than replaces it.

Below left: A *Posidonia australis* flower

Below: Using a quadrat to monitor subtidal seagrass condition.



3.1

Quantifying seagrass condition – small sites 3.1.1 and 3.1.2

Gear

- GPS
- Quadrat placement marker buoys (weighted buoys with quadrat number)
- 50 x 50 cm quadrat x 3
- For measuring shoot length: 1 m flexible measuring tape (e.g. dressmaker's tape) for *Zostera nigricaulis*
OR 30 cm stainless steel ruler for *Zostera muelleri*
- Site information sheet (on waterproof paper)
- Datasheet (on waterproof paper)
- Clipboard and pencil
- Seagrass field ID sheet for seagrass, animals and algae
- Feral and In Peril Reefwatch VIC guide
- Waterproof digital camera
- Photo labels (See [Appendix 2: Photo quadrat labels protocol](#))

Note: Quadrats used in dense subtidal seagrass should be negatively buoyant (i.e. they must sink) and of a conspicuous colour or marked with fluorescent tape.

Locating quadrat positions

1. Arrive at the marine national park or marine sanctuary 1.5-2 hours before low tide.
Some wading, snorkelling and/or diving may be required.
2. The ranger with the assistance of one or two experienced volunteers will locate the quadrat placement areas using previously recorded GPS way points.

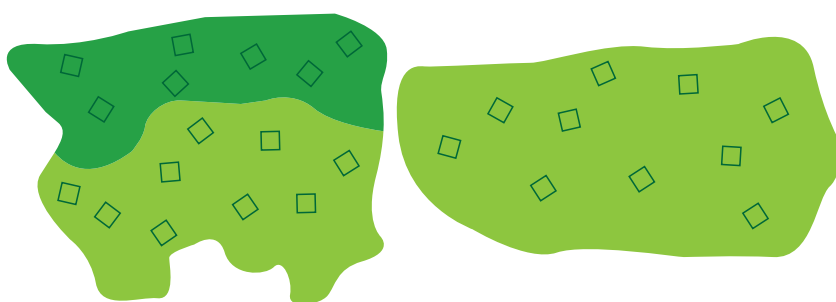


Figure 3.1 Possible quadrat arrangements within sites. Left diagram shows a site with 2 dominant species. The number of quadrats and locations are indicative only.

3. At each quadrat placement area the ranger will place a numbered marker.
4. Each team will be allocated to particular quadrat areas, e.g. team 1 will do quadrats 1-6, team 2 will do quadrats 7-12 etc.
5. Work in groups of two or more people per quadrat, with one person assessing the quadrat and the other writing.

3.1.1

Rapid method – small sites



Survey method

1. Fill in the site information sheet, recording weather, time, location, participants etc.
2. Take a quadrat photo ensuring that the entire quadrat frame is in the field of view, that the photo label doesn't obstruct the seagrass and take the picture as near vertical as possible (refer to notes on photo files later in this section). If it's not possible to get the entire quadrat in (e.g. *Zostera nigricaulis* in shallow water) in the photo, take a number of photos in a nearby deeper area where it is possible. Sometimes photos of subtidal seagrass will not be possible.
3. Record the general sediment type in the centre of each quadrat.

Sediment type	Description
Mud	Smooth and sticky texture
Fine sand	Fairly smooth texture with some roughness just detectable
Sand	Rough grainy texture, particles clearly distinguishable
Coarse sand	Coarse texture, particles loose
Gravel	Very coarse texture, with some small stones

4. Record percentage cover (0 - 100%) of each seagrass species (see ID sheet), algae (not epiphytes), bare sediment or any other habitat type in the quadrat. When added together these should come to 100%.
5. Note any flowers or reproductive structures that might be present in or around the whole site (see identification sheet).
6. Determine the percentage cover of epiphytes. The percentage cover of epiphytic algae is measured by estimating "the percentage of total surface area of leaves covered by algal growth". *Note that this is separate to the seagrass cover and doesn't need to add up to 100%.*
7. Record sightings of any marine pests (using the Feral and In Peril Guide), indications of disturbance or dieback, or other interesting biological observations. Note that some introduced species such as the Asian date mussel *Musculista senhousia* are usually buried in fine sediment.
8. If time permits, you can also take photos of the general site area for future reference.

3.1.2

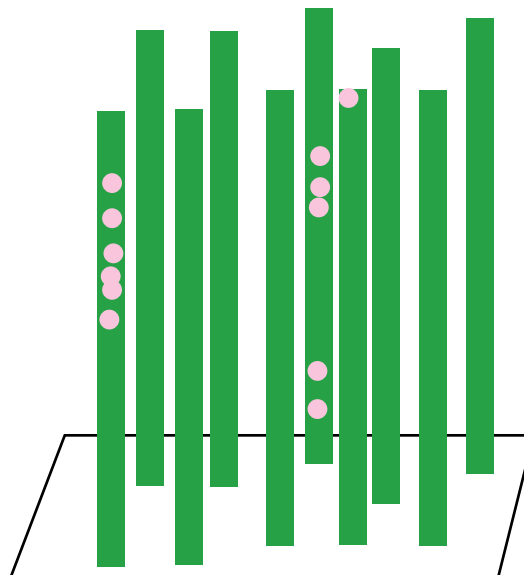
Detailed method* – small sites

SEA SEARCH METHODS		
LEVEL OF DIFFICULTY		
EASY	MODERATE	HARD

*this method should be conducted in conjunction with Rapid Methods (see previous section)

9. Shoot count (*Posidonia* only): count the number of shoots in a randomly selected half of the quadrat.
10. Using a ruler, measure in centimetres the average length of the leaf blades. Do this by haphazardly selecting at least 3 to 5 leaf blades from within the quadrat. Extend each leaf to its maximum length/height, without uprooting, and measure from the sediment to the leaf tip. Record the average length.
11. Explore inside the quadrat and identify (into broad taxonomic groups) and count mobile animals on the data sheets.

Epiphyte cover in this example is approximately 10%.





Finishing up

1. Check that your data sheets are complete.
2. Pack up gear.
3. Collate and give your completed data sheets to the Parks Victoria ranger who will store and make copies for volunteers to help enter the data onto the Sea Search database.
4. All gear should be washed thoroughly in freshwater and dried before storing

Photo files

1. Download and clearly name photos as .jpg with location, quadrat number and date details.
For example, an image from Jawbone on the 13 April 2012, at quadrat 4 would be 2012_04_13_Q4_J.
2. Location codes for labels are found in [Appendix 1: Photograph naming protocols](#).
3. Upload images onto the APP/Online database. Alternatively, forward image files (saved as .jpeg on USB) to the Park Ranger so they can be stored and talk with them about how you can help analyse images.

Notes

- If the quadrat is flattening seagrass leaves (e.g. when underwater), gently free where practical so that any assessments are made of upright leaves originating from within the quadrat.
- Avoid stepping in the quadrat, and minimise movement in the surrounding area to reduce sediment re-suspension and seagrass damage. Working down current will also help prevent sediment re-suspension (which can make measurements more difficult).

3.2

Initial site setup for quantifying seagrass condition – large sites

Initial site selection and set up is undertaken by the Parks Victoria Research Section in collaboration with rangers and is done on a separate day prior to a Sea Search sampling event.

Gear

- GPS
- Plastic star picket – 1 per site
- Small subsurface buoys – 1 per site
- Site labels (e.g. plastic cattle tags marked as “property of Parks Victoria, site number, and research permit number” where applicable) and UV resistant cable ties
- Site information sheet (on waterproof paper)

Setup method

1. Record site coordinates with a GPS and write down these details in the site information sheet.
2. Sites are positioned at the same depth in continuous or separate seagrass meadows.
3. Sites may be marked with a small subsurface buoy or fluorescent flagging tape attached to a plastic stake/star picket driven down flush with the sediment.
4. Ensure all gear lies close to the seafloor to avoid entanglement with boat anchors or other equipment.
5. Attach the site label (Figure 3.2) to the star picket with a plastic cable tie so that it sits on the sediment/seagrass.

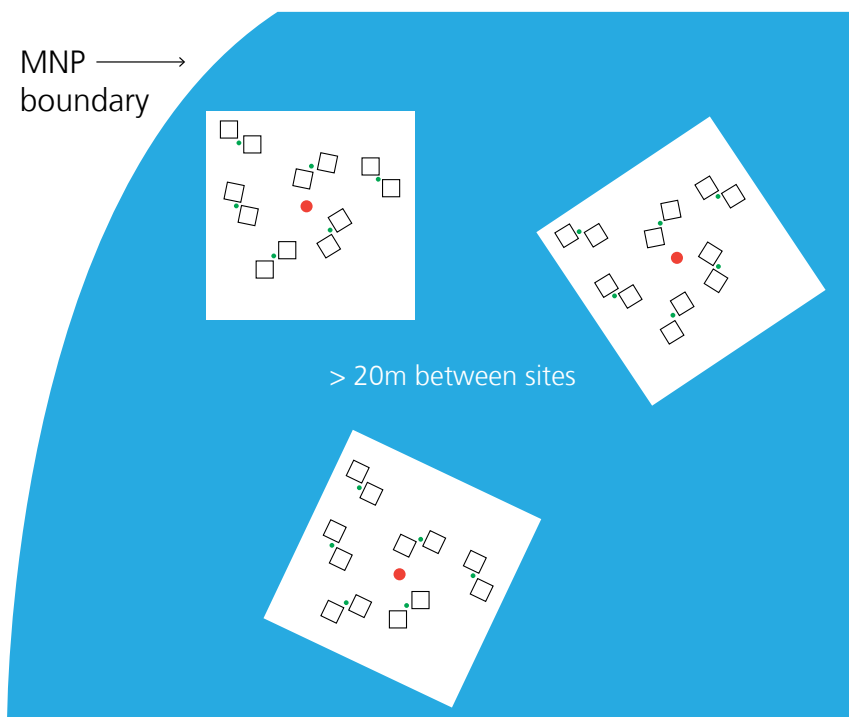


Figure 3.2 Large site set up: red dot indicates permanent marker/centre of site, squares indicate quadrat placement for sampling.

3.2

Quantifying seagrass condition – large sites 3.2.1 and 3.2.2

Gear

- GPS
- Weighted surface buoys on 3-4 m of thin rope to mark quadrat points x 6
- 50 x 50 cm quadrats – 2 per quadrat point
- Site information sheet (on waterproof paper)
- Seagrass datasheet (Rapid or Detailed) – 1 per recorder (on waterproof paper)
- Clipboard and pencil – 1 per recorder
- Waterproof digital camera
- Table 3.2 – substrate type
- Seagrass field ID sheet for animals, seagrass and algae
- Feral and In Peril Reefwatch VIC guide
- Photo labels (See Appendix for examples)
- Tools for measuring water quality parameters such as N, P, pH and temperature (optional)
- Secchi disc (optional)

Note: Quadrats used in dense subtidal seagrass should be negatively buoyant (i.e. they must sink) and of a conspicuous colour or marked with fluorescent tape.

Locating sites and quadrat positions

1. Locate sites using a GPS. If possible sites will be marked with permanent subsurface buoys which may not be visible from the surface.
2. Haphazardly deploy 6 weighted surface marker buoys within a 20 m x 20 m area around the GPS point/site marker. These surface marker buoys will identify quadrat pair locations.
3. Working in pairs, place 2 quadrats (50 cm x 50 cm) on the substrate at the base of each marker.

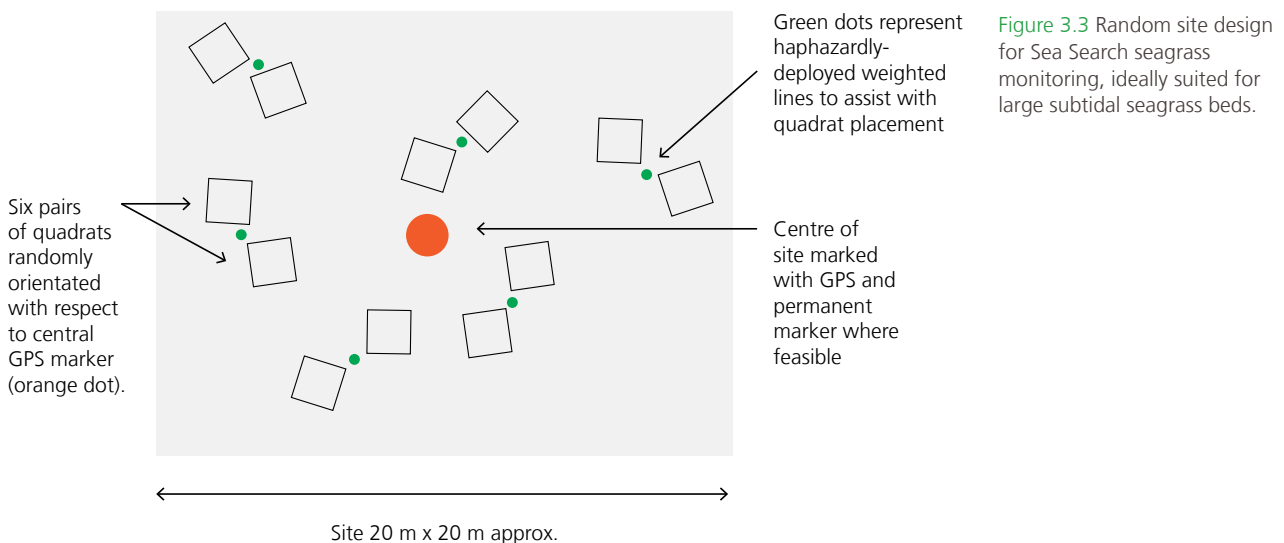


Figure 3.3 Random site design for Sea Search seagrass monitoring, ideally suited for large subtidal seagrass beds.

3.2.1

Rapid method – large sites



Survey method

1. Fill in the site information sheet, recording weather, time, location, participants etc.
2. Take a quadrat photo ensuring that the entire quadrat frame is in the field of view, that the photo label doesn't obstruct the seagrass and take the picture as near vertical as possible (refer to notes on photo files later in this section). If it's not possible to get the entire quadrat in (e.g. *Z. nigricaulis* in shallow water) in the photo, take a number of photos in a nearby deeper area where it is possible. Sometimes photos of subtidal seagrass will not be possible.
3. Record the general sediment type in the centre of each quadrat.

Sediment type	Description
Mud	Smooth and sticky texture
Fine sand	Fairly smooth texture with some roughness just detectable
Sand	Rough grainy texture, particles clearly distinguishable
Coarse sand	Coarse texture, particles loose
Gravel	Very coarse texture, with some small stones

4. Record percentage cover (0 - 100%) of each seagrass species (see ID sheet), algae (not epiphytes), bare sediment or any other habitat type in the quadrat. When added together these should come to 100%.
5. Note any flowers or reproductive structures that might be present in or around the whole site (see identification sheet).
6. Determine the percentage cover of epiphytes. The percentage cover of epiphytic algae is measured by estimating "the percentage of total surface area of leaves covered by algal growth". *Note that this is separate to the seagrass cover and doesn't need to add up to 100%.*
7. Record sightings of any marine pests (using the Feral and In Peril Guide), indications of disturbance or dieback, or other interesting biological observations. Note that some introduced species such as the Asian date mussel *Musculista senhousia* are usually buried in fine sediment.
8. If time permits, you can also take photos of the general site area for future reference.

3.2.2

Detailed method* – large sites

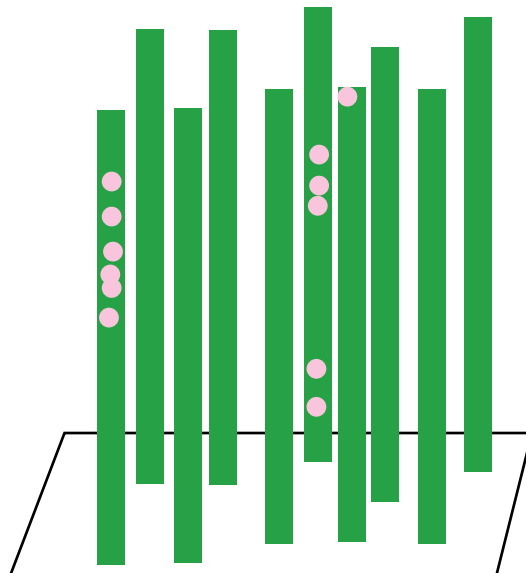
SEA SEARCH METHODS
LEVEL OF DIFFICULTY

EASY MODERATE **HARD**

*this method should be conducted in conjunction with Rapid Methods (see previous section)

9. Shoot count (*Posidonia* only): count the number of shoots in a randomly selected half of the quadrat.
10. Using a ruler, measure in centimetres the average length of the leaf blades. Do this by haphazardly selecting at least 3 to 5 leaf blades from within the quadrat. Extend each leaf to its maximum length/height, without uprooting, and measure from the sediment to the leaf tip. Record the average length.
11. Explore inside the quadrat and indentify (into broad taxonomic groups) and count mobile animals on the data sheets.

Epiphyte cover in this example is approximately 10%.





Site information

At each site other physical parameters may be recorded including turbidity (Secchi disc), water temperature (dive computer/measuring tool) and nutrient levels (measuring tool). This information should be recorded on the site information sheet.

Finishing up

1. Check all datasheets are complete.
2. Pack up gear.
3. Collate and give your completed data sheets to the Parks Victoria ranger who will store and make copies for volunteers to help enter the data onto the Sea Search database.
4. All gear should be washed thoroughly in freshwater and dried before storing.

Photo files

1. Download and clearly name photos as .jpg with location, site and date details. For example, an image from Corner Inlet on the 13 April 2012, at site 1, quadrat 4 would be 2012_04_13_S1Q4_CI.
2. Location codes for labels are found in [Appendix 1: Photograph naming protocols](#).
3. All Images should be uploaded to the APP/Online database. Alternatively, forward image files (saved as .jpeg on USB) to the Park Ranger so they can be stored and talk with them about how you can help analyse images.

Notes

- If the quadrat is flattening seagrass leaves (e.g. when underwater), gently free where practical so that any assessments are made of upright leaves originating from within the quadrat.
- Avoid stepping in the quadrat, and minimise movement in the surrounding area to reduce sediment re-suspension and seagrass damage. Working down current will also help prevent sediment re-suspension (which can make measurements more difficult).

3.3

Seagrass boundary monitoring

Are the seaward and landward boundaries of the seagrass meadow expanding or contracting?

Is the direction of change constant, or is it variable (i.e. some years advancing landwards, some years retreating)?

Are species zones moving? e.g. are subtidal species (*Zostera nigricaulis*) moving landward? (This a potential indicator of sea level rise or change in water clarity).

Seagrasses create habitats for a range of species, sequester carbon, stabilise sediments, and are primary producers. The size of seagrass beds is influenced by natural processes such as seasonality, light availability, water depth, sediments and hydrodynamics, but it can also be affected by impacts such as water pollution (including turbidity), physical disturbance (e.g. trampling, anchor scar) and sediment burial (e.g. run-off).

Different seagrass species may naturally be found at different depths but a reduction in the amount of light penetrating the water may alter their distribution. Light can be blocked by sediments in the water from land runoff or dredging (turbidity) or overgrowth of some nutrient-loving algae (epiphytes) in response to excess nutrients from agriculture and sewage. Damage to seagrass beds can occur as a decline in overall growth or even death of entire areas, retreat of boundaries, and fragmentation.

Sea Searchers measure the distance of the inner and outer edges of the seagrass meadow from a fixed point. Monitoring the deep and shallow boundaries of seagrass meadows over time can show whether a seagrass meadow is expanding, contracting, or moving; and so provide a measure of seagrass extent inside marine protected areas. Monitoring the movement of species dominance (e.g. *Zostera nigricaulis* expanding shoreward into areas previously dominated by *Zostera muelleri*) across the seagrass bed can also tell us about changes to local hydrology and possibly sea level rise.

This method should be conducted annually within the same season each year.



Left: A clearly defined seagrass boundary.

3.3.1

Seagrass boundary monitoring – small sites (<100 m only)

SEA SEARCH METHODS LEVEL OF DIFFICULTY		
EASY	MODERATE	HARD

Gear

- GPS
- Compass
- Short plastic star picket x 3
- Pegs for staking end of measuring tapes x 6
- Dive slate and pencil and rubber bands for securing data sheets
- Data sheet – 1 per site (on waterproof paper)
- Site information sheet (on waterproof paper)
- Waterproof digital camera
- 50 m or 100 m transect tape x 3

Initial site setup (this can be done on the first survey but only needs to be done once)

1. Parks Victoria rangers will establish 3 fixed points near the deep and 3 fixed points near the shallow boundaries of the seagrass meadow which will be marked by GPS waypoints.
2. 3 transects that run from deep markers to shallow markers will be used for sampling, the direction these transects run will be recorded as a compass bearing.
3. Fixed points near the deep boundary can be marked by a small subsurface buoy or fluorescent flagging tape attached to a plastic star picket driven down flush with the sediment to allow future relocation.
4. Any subsurface gear should lie close to the seafloor to avoid entanglement with boat anchors or other equipment and have a label identifying the gear as the property of Parks Victoria.

Survey methods

1. Fill in the site information sheet.
2. Starting with the shallow edge, locate transect 1 (T1). If no permanent marker is present, relocate the point using GPS, maps and land or navigational features and mark with a plastic peg.
3. Measure the distance (seaward/landward, [Figure 3.4](#)) from the shallow edge marker to the first leaf; and the point where an adult hand placed flat on the sediment touches at least two separate plant parts. Make sure you follow the same compass bearing as for previous surveys.
 - a. If the stake is now outside the seagrass bed indicate this on the datasheet.

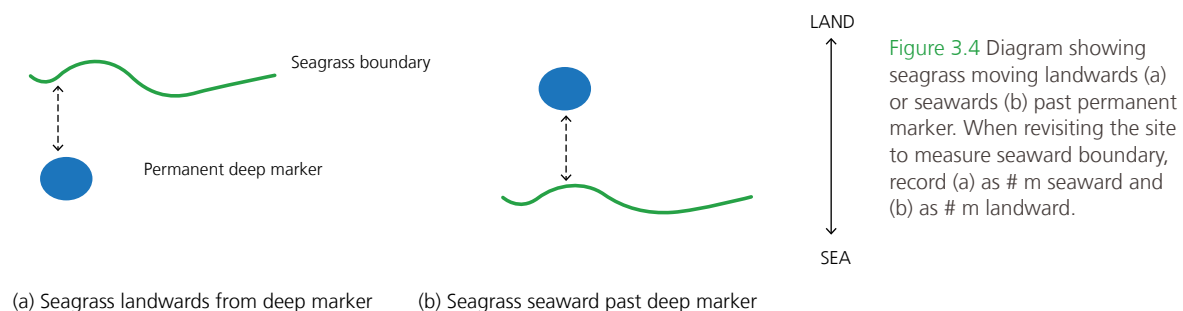


Figure 3.4 Diagram showing seagrass moving landwards (a) or seawards (b) past permanent marker. When revisiting the site to measure seaward boundary, record (a) as # m seaward and (b) as # m landward.



4. Take photos of the seafloor around the marker.
5. In addition to photos of the seafloor take photos using the boundary maker as a photo point along the boundaries in both directions.
6. Also record whether the edge of the bed is well defined, patchy, or gradual on the datasheet.
7. Run out the transect tape from the shallow edge marker to deep edge marker (Figure 3.5).

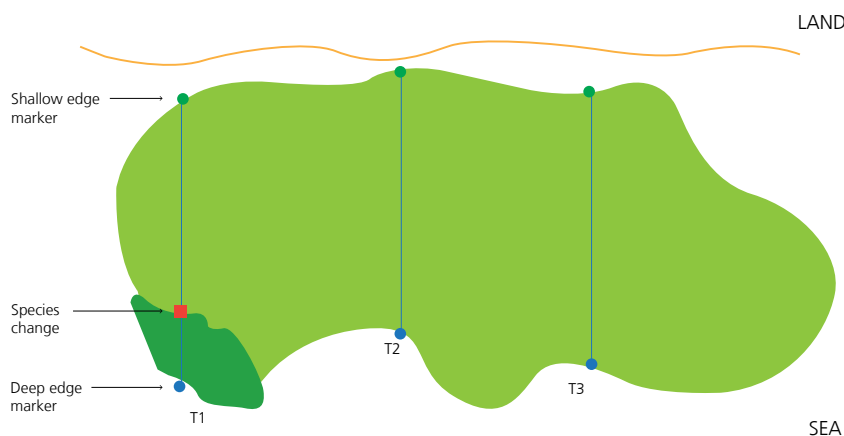


Figure 3.5 Diagram showing layout of transects over seagrass bed on the day of set up. If a change in dominant seagrass species occurs it is important to note the distance from the shallow edge marker.

8. To mark a change in dominant seagrass species along the transect (sites < 100 m only, Figure 3.2), record the distance along the transect tape where approximately 50% of each species occur under an adult hand, take photos of seafloor in area.
9. Record the deep seagrass boundary by repeating step 3 at the deep marker.
10. Draw a map on the datasheet to show boundary edges and species dominance.
11. Ensure the transect data sheet for the first shallow boundary marker is complete then repeat for the shallow then deep marker on each transect.

Finishing up

1. Check your data sheets are complete.
2. Pack up gear (including temporary markers).
3. Collate and give your completed data sheets to the Parks Victoria ranger will store the data and make copies for volunteers to help enter the data onto the Sea Search database.
4. All gear should be washed thoroughly in freshwater and dried before storing.

Photo files

1. Download and clearly name photos with site, and date details. For example, an image from the deep edge in Jawbone MS on 13 April 2012, at site 1, would be 2012_04_13_S1_d_J.
2. Location codes for labels are found in [Appendix 1: Photograph naming protocols](#).
3. Upload images onto the APP/Online database. Alternatively forward image files (saved as .jpeg on USB) onto the Park Ranger so they can be stored and talk with them about how you can help analyse images.

Notes

- It is important that boundary measurements are made in the same direction each survey time, ideally along a known compass bearing.
- Draw mudmap of area to show seagrass advance and retreat from boundary markers.

3.3.2

Seagrass boundary monitoring – large sites (>100m)



Setup gear

- GPS
- Compass
- Short plastic star picket x 3
- Pegs for staking end of measuring tapes x 6
- Dive slate and pencil and rubber bands for securing data sheets
- Data sheet – 1 per site (on waterproof paper)
- Site information sheet (on waterproof paper)
- Waterproof digital camera

Initial site setup (this can be done on the first survey but only needs to be done once)

1. Parks Victoria rangers will establish 3 fixed points near the deep and 3 fixed points near the shallow boundaries of the seagrass meadow which will be marked by GPS waypoints.
2. Fixed points near the deep boundary can be marked by a small subsurface buoy or fluorescent flagging tape attached to a plastic star picket driven down flush with the sediment to allow future relocation.
3. Any subsurface gear should lie close to the seafloor to avoid entanglement with boat anchors or other equipment and have a label identifying the gear as the property of Parks Victoria.

Survey methods

1. Fill in the site information sheet.
2. Starting at the shallow edge, use your GPS and compass bearings to locate the site edge markers starting at the shallow edge (Figure 3.6).

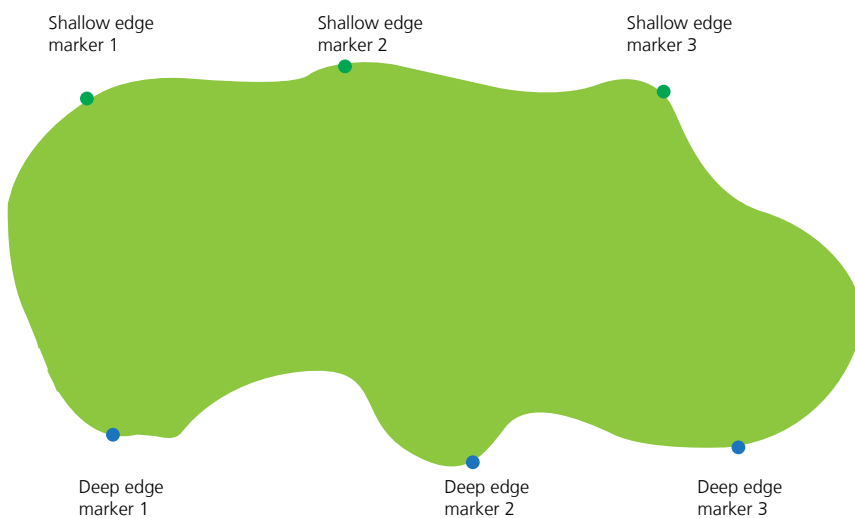


Figure 3.6 Diagram showing initial layout of markers over large seagrass bed for boundary monitoring site set up.



3. If there is no permanent marker, mark this point with a temporary plastic stake, making sure you remove this stake upon completion of all measurements.
4. Measure the distance (seaward/landward, [Figure 3.7](#)) from the shallow edge marker to the first leaf; and the point where an adult hand placed flat on the sediment touches at least two separate plant parts. Make sure you follow the same compass bearing as for previous surveys.
 - a. If the stake is now outside the seagrass bed indicate this on the datasheet.

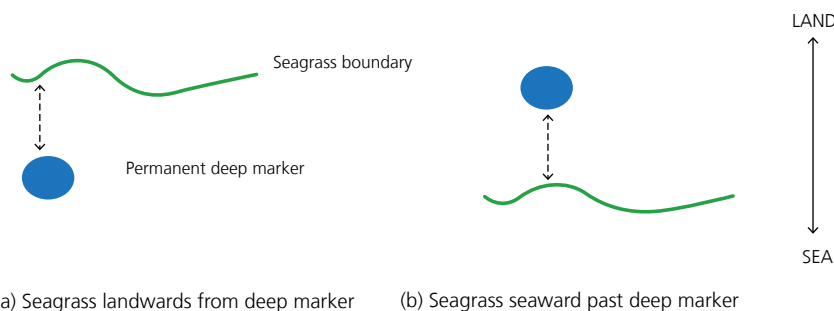


Figure 3.7 Diagram showing seagrass moving landwards (a) or seawards (b) past permanent marker. When revisiting the site to measure seaward boundary, record (a) as # m seaward and (b) as # m landward.

5. Take photos of the seafloor around the marker.
6. In addition to photos of the seafloor take photos using the boundary maker as a photo point along the boundaries in both directions.
7. Also record whether the edge of the bed is well defined, patchy, or gradual on the datasheet.
8. Draw a map on the datasheet to show boundary edges.
9. Ensure the data sheet for the first shallow boundary marker is complete then repeat for the next two shallow boundary markers and then the deep boundary markers.

Finishing up

1. Check your data sheets are complete.
2. Pack up gear (including temporary markers).
3. Collate and give your completed data sheets to the Parks Victoria ranger will store the data and make copies for volunteers to help enter the data onto the Sea Search database.
4. All gear should be washed thoroughly in freshwater and dried before storing.

Photo files

1. Download and clearly name photos with site, and date details. For example, an image from the deep edge in Jawbone MS on 13 April 2012, at site 1, would be 2012_04_13_S1_d_J.
2. Location codes for labels are found in Appendix 1 - Location names and codes.
3. Upload images onto the APP/Online database. Alternatively, forward image files (saved as .jpeg on USB) onto the Park Ranger so they can be stored and talk with them about how you can help analyse images.

Notes

- It is important that boundary measurements are made in the same direction each survey time, ideally along a known compass bearing.
- Draw mudmap of area to show seagrass advance and retreat from boundary markers.



Conclusion

Completing a Sea Search session

At the end of a day of Sea Searching, it is important to ensure the following tasks are undertaken before leaving the site.

Once monitoring has been completed, supervisors must do a head-count to check that all participants are present or accounted for. This is important especially if Sea Search methods undertaken require participants to snorkel or SCUBA dive.

Ensure all equipment has been collected and nothing has been left behind at the monitoring site.

Sea Searchers should check that their datasheet has been filled in and all numbers are clear and legible. Check figures for discrepancies and anomalies with errors corrected and/or annotations added, if necessary.

Wash quadrats, slates, and any other equipment in fresh water. This assists in removing any excess sand and mud, and any pests that might hitch a ride. Ensure the equipment is dry before placing in storage.

Data sheets

Survey data sheets are provided as appendixes to this manual. These can be copied for use in monitoring programs. Semi-waterproof paper is available from Parks Victoria, and can be useful for these monitoring activities. The data sheets can also be provided on plain paper with a view to transferring the data to master sheets soon after the excursion.

Notes should be taken using pencils which will continue to write even if paper is damp.

Sea Search aims to collect scientific data within the capabilities of the volunteers and adjustments may be made to the methods and data sheets to reflect the current best practice and the skill levels of those undertaking the surveys.

Once checked and completed the data sheets should be copied and provided to the local Parks Victoria office for filing and entering into a database.

An online data base for Sea Search surveys is available through an APP and online via biocollect for direct data entry by Sea Search volunteers in the field or as soon as possible.

Marine pests

Unfortunately a number of introduced animals, plants, and diseases occur in Victoria's waters, which can have a significant impact on local marine life. If you identify a potential pest, bring it to the attention of Parks Victoria by calling 13 1963 or by speaking to local staff.

- Take a photo and record the location.
- Do not remove the suspected pest. Pests may look similar to our native plants and animals.
- To avoid spreading marine pests and diseases, thoroughly wash equipment and clothing in fresh water following completion of a Sea Search excursion.



Left: The Northern Pacific Seastar, *Asterias amurensis*, is found throughout Port Philip Bay. Ensure you don't contribute to its colonisation of new areas.

What happens next?

The data you collect is carefully reviewed, managed, and utilised to inform marine protected area programs.

Where does the data go?

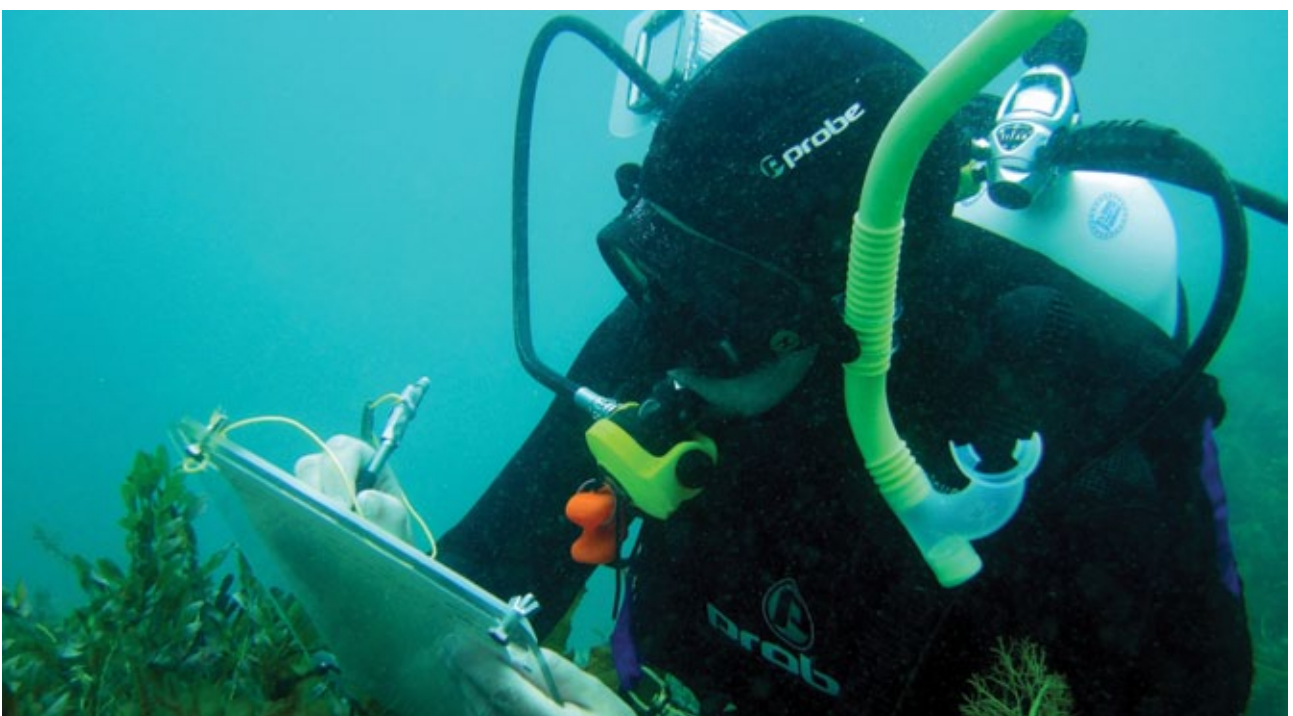
Marine national parks and marine sanctuaries are protected primarily for conservation of marine values. Their management is guided by the establishment of clear Conservation Outcomes, providing goals for the protection of important natural values and the reduction in the levels of threats to these values.

Sea Search monitoring methods have been developed with these outcomes in mind, and aim to inform on progress in meeting these conservation goals for the parks. Data collected by volunteers through the Sea Search program is added to a state-wide database for Victoria's marine national parks and marine sanctuaries.

Information in the Sea Search database is used to complement the less regular formal monitoring to assess park condition undertaken by scientists. The data is reviewed periodically by marine scientists and used to understand the state of the park and any changes observed, and to assess how the park is travelling in relation to achieving its conservation goals.

Sea Search data makes an important contribution to reports on the state of the parks and importantly to help inform future management directions. It is important to recognise your contribution of data collection noting that volunteer observations will incrementally build on existing knowledge help assess the effectiveness of management activity.

Below: Parks Victoria recognises the significant efforts contributed by volunteers in collecting marine information.



Who reviews the information

Sea Search data is initially collated and reviewed by local Parks Victoria rangers to note any significant findings that may be important, such as the recording of new species or significant changes in the areas studied. This is an important initial step of the process and can focus attention on emerging threats or changes in condition that may need a direct or immediate management intervention.

Information entered in the state-wide database is analysed by marine scientists working for Parks Victoria or by independent reviewers. This assessment includes a review of the quality of the information gathered including its statistical validity. Data is used to assess the overall trends in park conditions. This information helps determine the level to which park objectives are being met, and ultimately helps guide the allocation of resources and time for the future management of the park.

Without the contribution of community volunteers through the Sea Search program, there are gaps in the timeliness of data collected in relation to the condition of the park. Formal scientific

monitoring occurs in most parks over multi-year cycles, so any changes occurring will take much longer to observe than through more regular Sea Search monitoring data.

Can I look at the information that has been collected by my group or others? The new Sea Search database allows information to be entered directly by volunteers and Parks Victoria staff through an APP or web based interface. This will allow volunteers to contribute their own information and observations to input directly to this information bank. The database has inbuilt limits so that information that may be inaccurate is flagged for review.

Queries on the information gathered by community volunteers will be possible through the new database and will allow participants to access data that has been collected in the past by their own or other groups across the state. This information will be provided in easy to understand graphical formats and simple reports.

Reports based on contracted monitoring of Victoria's marine national parks and marine sanctuaries are regularly

published online on Parks Victoria's website and are available for all to review and use.

Is the information safe

Parks Victoria recognises the significant investment by volunteers in collecting information through the Sea Search program and are committed to protecting the data provided through this program.

Hard copies of datasheets are stored locally while the database itself is part of the Atlas of Living Australia, hosted by CSIRO. A regular backup of this database ensures that no data will be lost and will continue to be available for review purposes well into the future.

Sea Search community

Like the marine national parks and sanctuaries they monitor, Sea Search activities take place right across Victoria. Parks Victoria has a dedicated Sea Search page on Facebook, which is a fantastic way of sharing photos and anecdotes from your monitoring activities. 'Like' the page and see what other volunteers and rangers are doing and discovering around the state.



Left: 'Like' the Sea Search page on Facebook to keep in touch with volunteers around Victoria, and see what is happening in other marine protected areas.

Contacts and resources

Program contact

Parks Victoria

Visit the Sea Search website at www.parkweb.vic.gov.au/get-involved/volunteer/sea-search

To contact any Parks Victoria office call 13 1963.

Further information on Victoria's park system can be obtained from: www.parkweb.vic.gov.au

Register as a volunteer - www.parkconnect.vic.gov.au
Sea Search database - www.biocollect.ala.org.au

Other useful contacts

Department of Environment, Land and Planning (DELWP)

Ph: 136 186

www.coastsandmarine.vic.gov.au

Department of Economic Development, Jobs, Transport and Resources (DEDJTR)

– Marine Pests reporting
marine.pests@ecodev.vic.gov.au

EPA Victoria – Pollution report line

Ph: 1300 EPA VIC (1300 372 842)

www.epa.vic.gov.au

Fisheries Victoria

Offence Reporting Hotline

Ph: 13FISH (133 474)

ReefWatch Victoria

Ph: 03 9341 6500

www.vnpa.org.au/reefwatch

Coastcare Victoria

www.coastsandmarine.vic.gov.au/coastal-programs/coastcare

Online resources

Algae Base (ID resource)

www.algaebase.org

Atlas of Living Australia

www.ala.org.au

BirdLife Australia

(survey info and publications)

www.birdlife.org.au/

Bowerbird

(natural history observations and data)

www.bowerbird.org.au/

Census of Marine Life

(network to compile marine diversity, distribution, and abundance data)

www.coml.org.au

eFlora (Algae ID Resource)

www.flora.sa.gov.au/algae_revealed/index.shtml

Explore Underwater Victoria

(Victorian marine life images and video)

www.exploreunderwatervictoria.org.au

Friends of the Bluff - Barwon

Heads (guide books, apps)

www.barwonbluff.com.au

Marine Care Ricketts Point

(programs and ID guides)

www.marinecare.org.au

Marine Discovery Centre Rocky

Shores (online intertidal surveys)

www.rockyshores.aus.info

Marine Education Society of

Australasia (resources for schools) www.mesa.edu.au

Museum Victoria

(ID resource for Victorian life)

www.museumvictoria.com.au

Port Phillip Bay Taxonomic Toolkit

(ID resource)

www.portphillipmarinelife.net.au/

Redmap

(mapping unusual marine species)

www.redmap.org.au/

Reef Life Survey

(subtidal reef monitoring)

www.reeflifesurvey.com/

Further reading

Australian Marine Life. The Plants and Animals of Temperate Waters, Second Edition. GJ Edgar, 2008.

Life on the Rocky Shores, VNPA, 2010.

Museum Victoria Field Guides to Marine Life series, Museum Victoria.

A Guide to Southern Temperate Seagrasses, Michelle Waycott, Kathryn McMahon, Paul Lavery, 2014.

Coastal Invertebrates of Victoria – An Atlas of Selected Species (revised), Field Naturalists Club of Victoria, 2006.

Coastal Marine Ecology of Temperate Australia, Underwood & Chapman, 1999.

Marine Ecology, Connel & Gillanders, 2007



Appendices

Appendix 1: Photograph naming protocols

To assist Parks Victoria staff in accurately filing and referencing Sea Search photographs, it's important to follow the file naming protocol outlined here.

Camera Settings

When taking photos set the camera to take smaller sized images where possible e.g. 300-400 kB. Alternatively compress images using a program such as Microsoft picture manager. There is limited space for storing images so keeping the file sizes small will prevent problems with storage.

Saving and naming images

1. Download and clearly name photos with site, and date details. For example, if doing method 3.3.2 (large site seagrass boundaries) an image from the deep edge in Corner Inlet on the 13th of April 2012, at site 1, would be **PV_COR_2012_04_13_S1_d**. An image from Barwon Bluff, on the rocky intertidal, on the 13th of April 2012, would be **PV_BAR_2012_04_13_rockyint**.

2. Location codes for labels are found below.
3. Each summary method includes an example of how to label a photo relevant to the method being used.

Sending images to rangers

Images should be saved as a .jpeg file type and uploaded to the database or onto a USB and forwarded to rangers.

Storing images on parks network

Rangers should upload images to the database or store the images by date order in the relevant method folder for your region on the S: drive.

Location codes

Site	Code
Cape Howe Marine National Park	HOW
Point Hicks Marine National Park	HIC
Ninety Mile Beach Marine National Park	NIN
Corner Inlet Marine National Park	COR
Wilson's Promontory Marine National Park	WIL
Bunurong Marine National Park	BUN
Churchill Island Marine National Park	COR
French Island Marine National Park	FRE
Yaringa Marine National Park	YAR
Port Phillip Heads Marine National Park (Swan Bay)	PPH_SW
Port Phillip Heads Marine National Park (Mud Islands)	PPH_MI
Port Phillip Heads Marine National Park (Point Nepean)	PPH_PN
Port Phillip Heads Marine National Park (Point Lonsdale)	PPH_PL
Point Addis Marine National Park	ADD
Twelve Apostles Marine National Park	TWE
Discovery Bay Marine National Park	DIS
Beware Reef Marine Sanctuary	BEW
Mushroom Reef Marine Sanctuary	MUS
Ricketts Point Marine Sanctuary	RIC
Jawbone Marine Sanctuary	JAW
Point Cooke Marine Sanctuary	COO
Barwon Bluff Marine Sanctuary	BAR
Point Danger Marine Sanctuary	DAN
Eagle Rock Marine Sanctuary	EAG
Marengo Reefs Marine Sanctuary	MAR
The Arches Marine Sanctuary	ARC
Merri Marine Sanctuary	MER

Appendix 2: Photo quadrat labels protocol

Use the following naming protocols to generate a set of photo quadrat labels for your MPA. Labels should be printed with a grey background to minimize problems with glare, and ensure legibility when reviewed on screen, as per the examples shown.

Intertidal cover quadrats

Use the following naming protocol: **Site code_Zone_Quadrat number**.

E.g. Lower intertidal zone quadrats at Barwon Bluff Marine Sanctuary will look like this:

BAR_L_Q1	BAR_L_Q2
BAR_L_Q3	BAR_L_Q4
BAR_L_Q5	Etc

E.g. Mid intertidal zone quadrats at Barwon Bluff Marine Sanctuary will look like this:

BAR_M_Q1	BAR_M_Q2
BAR_M_Q3	BAR_M_Q4
BAR_M_Q5	Etc

Seagrass small sites

Use the following naming protocol: **Site code_Seagrass species abbreviation_Quadrat number**

E.g. Seagrass quadrats monitoring *Zostera muelleri* at Jawbone Marine Sanctuary will look like this:

JAW_Zm_Q1	JAW_Zm_Q2
JAW_Zm_Q3	JAW_Zm_Q4
JAW_Zm_Q5	Etc

Seagrass large sites

Use the following naming protocol: **Site code_Within site code_Quadrat marker_Quadrat replicate (A or B)**

E.g. Seagrass quadrats monitoring Tin Mine Cove at Corner Inlet will look like this:

COR_TM_Q1A	COR_TM_Q1B
COR_TM_Q2A	COR_TM_Q2B
COR_TM_Q3A	Etc

Appendix 3: Sea Search checklists

Prepare



Weather

- weather forecast
- tidal predictions
- sea conditions

Communicate with volunteers

- confirm time and location
- advise of weather

Equipment

- collect from Parks Victoria office or
- confirm ranger to bring to site
- print data sheets

On the day



Clothing

- enclosed footwear
- rain jacket
- warm clothes / loose sun-protective clothing
- towel
- change of clothes
- hat
- sunscreen
- sunglasses
- water
- snacks

Safety

- first aid kit
- mobile phone
- emergency numbers
- brief volunteers on hazards
- nominate volunteer to watch for hazards

Quality control

- ensure volunteers are adequately briefed on each activity
- nominate quality control person

Follow up



Data / Images

- check data sheets and submit to ranger
- save images labelled as per photograph protocols
- upload photograph to database/submit photographs to ranger

Enquiries

- submit unknown species images to ranger for follow-up

Field information sheet



Location: _____ Date: _____

Site(s): _____ Start time: _____ End time: _____

Participants: _____

Sea Search methods: _____

Conditions

Wind Speed (km/hr): _____ Wind direction: _____

Air temperature(°C): _____

Rain (circle): _____ YES / NO _____ Cloud cover (circle): _____ None Low Med High

Time low tide: _____ Height low tide (m): _____

Water clarity (circle): _____ Excellent / Fair / Poor _____ Water temp (°C): _____

Other notes:

1.1 Fixed point photos



Park: _____ Site: _____

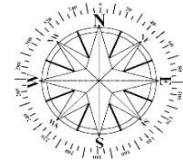
Photographer (full name): _____ Date: _____ Time: _____

GPS Coordinates (WGS 84): Lat. _____ ° _____ ' _____ "S Ecosystem Type: _____

Lon. _____ ° _____ ' _____ "E

Photo No.	Compass bearing for middle of photo (° clockwise from N)	Short comments (e.g. about changes in size/condition of habitat, sand movement, pollution events etc.)

Mud map of photopoint location:



1.3 Sea Search Patrol

Marine National Park/Marine Sanctuary: _____ Site: _____ Date: _____

Cloud cover/Wind strength/Rainfall: _____ / _____ / _____ Method: Snorkel / Walk

Recorder (full names) _____ Start time _____ End time _____

Total duration of activity observed _____ minutes

Activity	Number	Activity	Number	Activity	Number	Observation	Number/Description
Stationary		Swimming		Dog walking ON lead		Disturbance of wildlife	
Walking		Wading		Dogs OFF lead		Litter	
Overturning rocks		Dive/Snorkel		Motor boats		Pollution	
Collecting		Kayak/surf ski		Sail boats			
Fossicking/Exploring		Line Fishing					
Surfing		Spear Fishing					

Records of disturbance, litter, range expanding species, or other impacts (any marine pests use SPECIES IMAGE LIBRARY).

<p>Biological notes: E.g. snail eggs, unusual abundance of species</p> 	<p>Mudmap/notes:</p>
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2.1 & 2.2 Intertidal Reef Surveys - Rapid & Detailed (Low Intertidal Zone)



Park: _____ Site (if relevant): _____

Observers (full names): _____ Sea Search method: _____

Date: _____ Start Time: _____ End Time: _____

Quadrat No.	Point intercept counts (Photoquadrats & Rapid method 2.1)								Invertebrate No. (Detailed method 2.2)							
		<i>Hormosira banksii</i>	<i>Galeolaria caespitosa</i>	<i>Ulva</i> spp.	<i>Limnoperla pulex</i>	Encrusting coralline	Coralline turf	Other	<i>Cellana tramoserica</i>	<i>Bembicium nanum</i> (Open coast)	<i>B. melanastomum</i> (Bays)	<i>Nerita atramentosa</i>	<i>Siphonaria zelandica</i>	<i>Austrocochlea constricta</i> (Open coast)	<i>A. porcata</i> (Bays)	Other
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
Comments (e.g. trampling, marine pests, other...)																


2.1 & 2.2 Intertidal Reef Surveys - Rapid & Detailed (Mid Intertidal Zone)



Park: _____ Site (if relevant): _____

Sea Search method: _____ Observers (full names): _____

Date: _____ Start Time: _____ End Time: _____

Quadrat No.	Point intercept counts (Photoquadrats & Rapid method 2.1)								Invertebrate No. (Detailed method 2.2)							
		<i>Hormosira banksii</i>	<i>Galeolaria caespitosa</i>	<i>Ulva</i> spp.	<i>Limnoperla pulex</i>	Encrusting coralline	Coralline turf	Other	<i>Cellana tramoserica</i>	<i>Bembicium nanum</i> (Open coast)	<i>B. melanastomum</i> (Bays)	<i>Nerita atramentosa</i>	<i>Siphonaria zelandica</i>	<i>Austrocochlea constricta</i> (Open coast)	<i>A. porcata</i> (Bays)	Other
1																
2																
3																
4																
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9																
10																
11																
12																
13																
14																
15																
16																
Comments (e.g. trampling, marine pests, other...)																

3.1 Setup sheet for ranger



Quad. No.	Seagrass species	Waypoints Latitude	Longitude	People assigned	Comments
1	<i>Zostera muelleri</i>				
2	<i>Zostera muelleri</i>				
3	<i>Zostera muelleri</i>				
4	<i>Zostera muelleri</i>				
5	<i>Zostera muelleri</i>				
6	<i>Zostera muelleri</i>				
7	<i>Zostera muelleri</i>				
8	<i>Zostera muelleri</i>				
9	<i>Zostera muelleri</i>				
10	<i>Zostera muelleri</i>				
11	<i>Zostera nigricaulis</i>				
12	<i>Zostera nigricaulis</i>				
13	<i>Zostera nigricaulis</i>				
14	<i>Zostera nigricaulis</i>				
15	<i>Zostera nigricaulis</i>				
16	<i>Zostera nigricaulis</i>				
17	<i>Zostera nigricaulis</i>				
18	<i>Zostera nigricaulis</i>				
19	<i>Zostera nigricaulis</i>				
20	<i>Zostera nigricaulis</i>				

Seagrass field information sheet (small site)



Location: _____ Date: _____

Site(s): _____ Start time: _____ End time: _____

Participants: _____

Sea Search methods: _____

Conditions

Wind Speed (km/hr): _____ Wind direction: _____

Air temperature(°C): _____ Water temp (°C): _____

Rain (circle): _____ YES / NO _____ Cloud cover (circle): _____ None Low Med High

Time low tide: _____ Tide level (m): _____ High = _____ Low = _____

Swell (m): _____ Water depth (m): _____

Sediment (circle): Mud / Fine Sand / Sand / Coarse Sand / Gravel _____ Visibility (m): _____

GPS coordinates for each quadrat

Quad. No.	Latitude	Longitude	Quad. No.	Latitude	Longitude
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

Other notes: e.g. general appearance of seagrass, distance from channels/gutters, current strength at time, presence/absence of sponges or other sessile marine life, notable sightings, photos taken etc.

Seagrass field information sheet (large site)



Location:	Date:	
Site(s):	Start time:	End time:
Participants:		
Sea Search methods:		

Conditions

Wind Speed (km/hr):	Wind direction:
Air temperature(°C):	Water temp (°C):
Rain (circle): YES / NO	Cloud cover (circle): None Low Med High
Time low tide:	Tide level (m): High = Low =
Swell (m):	Water depth (m):
Sediment (circle): Mud / Fine Sand / Sand / Coarse Sand / Gravel	Visibility (m):

GPS coordinate (take reading from middle of 6 quadrat pairs)

Other notes: e.g. general appearance of seagrass, distance from channels/gutters, current strength at time, presence/absence of sponges or other sessile marine life, notable sightings, photos taken etc.

3.1.1, 3.1.2, 3.2.1 & 3.2.2 Seagrass Condition Rapid & Detailed / Small & Large Sites (Seagrass Zone 1)




Park: _____ Site (if relevant): _____

Observers (full names): _____ Sea Search method: _____

Seagrass Zone (circle): intertidal / subtidal Main seagrass species: _____

Date: _____ Start Time: _____ End Time: _____

Quadrat No.	Rapid methods - 3.1.1 & 3.2.1									Detailed methods - 3.1.2 & 3.2.2							
		Sediment Type (see key)	<i>Zostera muelleri</i> (ZM) % cover	<i>Zostera nigricaulis</i> (ZN) % cover	<i>Posidonia australis</i> (PA) % cover	Bare sediment % cover*	Macroalgae % cover (not epiphytes)	Other:	Epiphytes % cover (see methods)	Canopy height (cm)	No. of Shoots (PA only - 1/2 quadrat)	Snails	Bivalves	Seastars	Urchins	Sponges	Other:
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	

Comments/observations:

Sediment Key: M=Mud FS=Fine Sand S=Sand CS=Coarse Sand G=Gravel.
* Distance between seagrass shoots must be more than a hand span to be categorised as "Bare sediments"

3.1.1, 3.1.2, 3.2.1 & 3.2.2 Seagrass Condition Rapid & Detailed / Small & Large Sites (Seagrass Zone 2)




Park: _____ Site (if relevant): _____

Observers (full names): _____ Sea Search method: _____

Seagrass Zone (circle): intertidal / subtidal Main seagrass species: _____

Date: _____ Start Time: _____ End Time: _____

Quadrat No.	Rapid methods - 3.1.1 & 3.2.1										Detailed methods - 3.1.2 & 3.2.2						
		Sediment Type (see key)	<i>Zostera muelleri</i> (ZM) % cover	<i>Zostera nigricaulis</i> (ZN) % cover	<i>Posidonia australis</i> (PA) % cover	Bare sediment % cover*	Macroalgae % cover (not epiphytes)	Other:	Epiphytes % cover (see methods)	Canopy height (cm)	No. of Shoots (PA only - 1/2 quadrat)	Snails	Bivalves	Seastars	Urchins	Sponges	Other:
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
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10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	


Comments/observations:

Sediment Key: M=Mud FS=Fine Sand S=Sand CS=Coarse Sand G=Gravel.

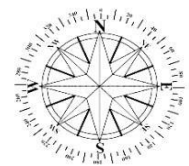
* Distance between seagrass shoots must be more than a hand span to be categorised as "Bare sediments"

3.3.1 & 3.3.2 Seagrass boundary mapping (small * & large sites)



Transect number (small sites only*)	Boundary marker number	Boundary marker description (circle)	Boundary marker coordinates (WGS 84)	Dominant seagrass species (ZM, ZN or PA)	Seagrass boundary type (well defined, patchy or gradual)	Distance of boundary from relevant marker (m)	Compass bearing of seagrass boundary from marker (° clockwise from N)	Direction of boundary from marker (inward/outward/at marker)	
1	1	Shallow							
	Zone change (small sites only*):						n/a		
	2	Deep edge							
2	3	Shallow edge							
	Zone change (small sites only*):						n/a		
	4	Deep edge							
3	5	Shallow							
	Zone change (small sites only*):						n/a		
	6	Deep edge							
7	7	Shallow edge							
	8	Deep edge							
9	9	Shallow							
	10	Deep edge							
11	11	Shallow edge							
	12	Deep edge							

Mud map of area:



Comments:

* Small sites are less than 100 m across

Seagrass species codes: ZM=Zostera muelleri ZN=Zostera nigricaulis PA=Posidonia australis .

Seagrass % cover examples - *Posidonia*



0%



2%



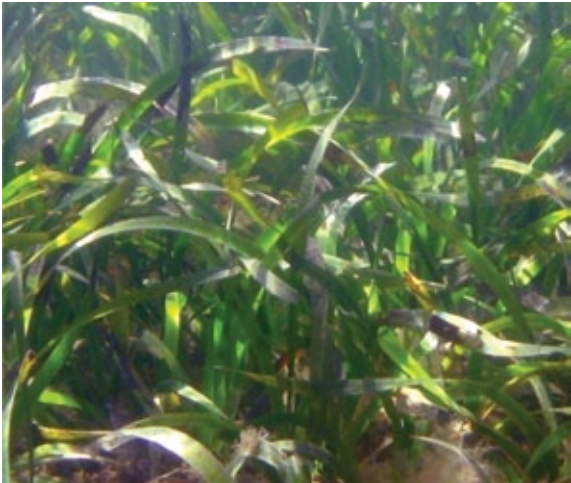
20%



65%



85%



95%

Seagrass % cover examples - *Zostera*



0%



3%



20%



65%



90%



100%

Intertidal identification sheet



Sea snails



Austrocochlea constricta
Ribbed Top Shell



Austrocochlea porcata
Wavy Top Shell



Nerita atramentosa
Black Nerite



Chlorodiloma adelaidae
Adelaide Top Shell



Nodilittorina unifasciata
Blue Periwinkle



Bembicium melanostomum
Wavy Edge Conniwink



Bembicium nanum
Conniwink



Cominella lineolata
Checkerboard Shell



Lepsiella vinosa
Wine-mouthed Lepsiella



Dicathais orbita
Dog Whelk

Limpets



Lunella (Turbo) undulata
Warrener



Cellana tramoserica
Variegated Limpet



Patelloida alticostata
Scaly Limpet



Siphonaria diemenensis
Striped False Limpet



Siphonaria zelandica
White False Limpet

Chitons



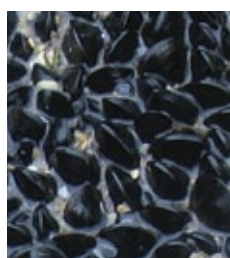
Patelloida latistrigata
Owl Limpet



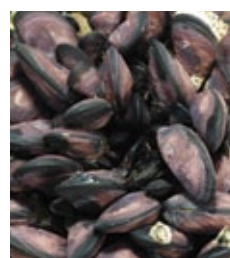
Ischnochiton australis
Chiton



Plaxiphora albida
Whitened Chiton



Limnoperna pulex
Little Black Horse Mussel



Austromytilus rostratus
Beaked Mussel

Mussels

Other molluscs



Onchidella nigricans
Ocean Beach Sea Slug

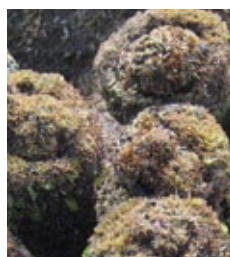


Aplysia sp.
Sea Hare



Scutus antipodes
Elephant Snail

Sea squirt



Pyura stolonifera
Cunjevoi

Worm



Galeolaria caespitosa
Tube Worm

Intertidal identification sheet



Echinoderms



Meridiastra calcar
Common Seastar



Parvulastra exigua
Little Green Seastar



Ophionereis schayeri
Brittle Star



Asterias amurensis
Northern Pacific Seastar
(pest)

Anemones



Actinia tenebrosa
Waratah Anemone



Aulactinia veratra
Sea Anemone



Anthothoe albocincta
Striped Anemone



Oulactis muscosa
Sand Anemone

Crustaceans



Cyclograpsus sp.
Shore Crab



Carcinus maenas
European Shore Crab
(pest)



Paragrapsus sp.
Shore Crab



Catomerus polymerus
Surf Barnacle



Chthamalus antennatus
Six-plated Barnacle



Chamaesipho tasmanica
Honeycomb Barnacle

Barnacles

Algae



Hormosira banksii
Neptunes Necklace



Padina fraseri
Fan shaped red algae



Cystophora sp.
Zig Zig Algae



Durvillaea potatorum
Bull Kelp



Eckonia radiata
Common kelp



Ulva sp.
Sea Lettuce



Capreolia implexa
Red Turfing Algae



Colpomenia sinuosa
Brown bubbles



Corallina officinalis
Coralline Algae



Encrusting Coralline Algae

Seagrass identification sheet



Seagrass species



Zostera nigricaulis
Dark-stem Eelgrass



Zostera muelleri
Narrow-leaf Eelgrass
(intertidal)



Halophila australis
Paddle Weed



Posidonia australis
Broad-leaf Seagrass

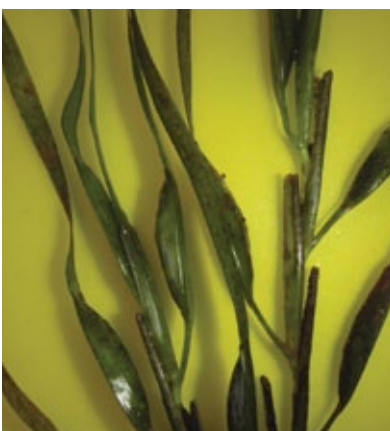


Amphibolis antarctica
Sea Nymph

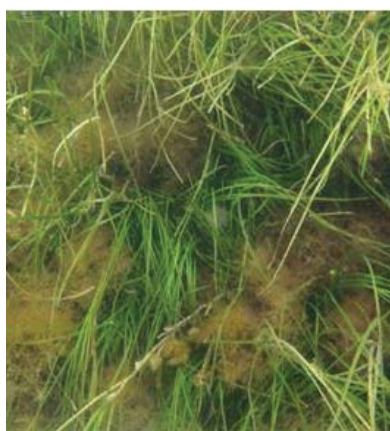


Posidonia
Seed Pod

Epiphytes



Zostera spp.
Flower Spike



Brown algae



Red algae

Seagrass identification sheet



Common animals



Fish



Crab



Bivalve



Sponge

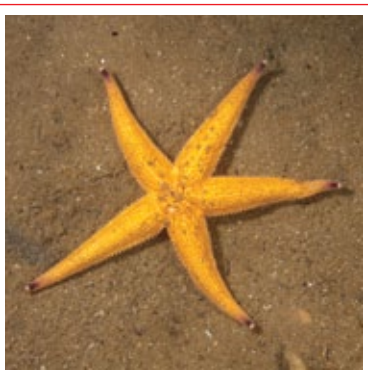


Seastar



Marine snail

Pests



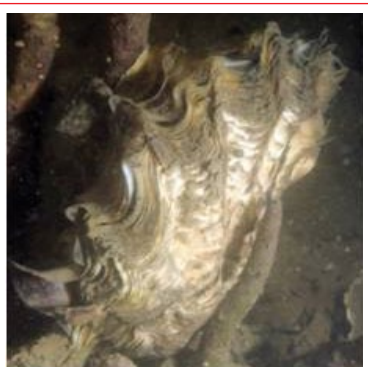
Asterias amurensis
North Pacific Seastar



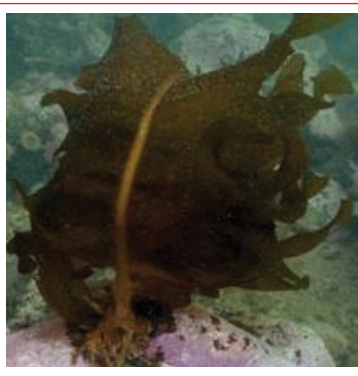
Codium fragile ssp. *fragile**



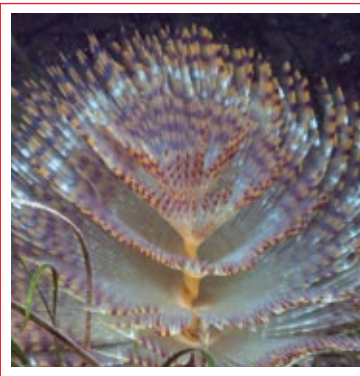
Musculista senhousia
Asian Date Mussel



Crassostrea gigas
Pacific Oyster



Undaria pinnatifida
Japanese Kelp



Sabella spallanzanii
European Fanworm

*This species can only be distinguished from identical natives by microscopic examination

Glossary

Algae

A photosynthetic, plant-like single- or multi-cellular organism.

Angiosperm

A group of plants where the seed is formed within an ovary.

Biodiversity

The number, relative abundance and genetic diversity of organisms on earth.

Bivalve

An animal in the mollusc group that has two valves joined at the margin by an elastic ligament and hinge teeth.

Carnivore

An animal that feeds exclusively on other animals as a food source.

Chlorophyll

The green pigment of plant cells, which is the receptor of light energy in photosynthesis.

Colonisation

The ability for an organism to settle and reproduce in a habitat.

Datum

A known, fixed point.

Desiccate

To dry out, lose moisture.

Ecology

The interaction between plants, animal and micro-organism communities.

Epiphyte

A small plant that grows attached to another plant.

Erosion

The loss of soil by the action of wind or water, or both.

Estuarine

The area or habitat where fresh water from a river meets the salt water of the ocean.

Filter-Feeder

Animals that obtain food by filtering suspended organisms and particles from a volume of water by passing the water over a set of specialised structures.

GPS

Global Positioning System used to navigate and mark locations.

Grazer

An animal that feeds on vegetable tissue from herbaceous plants.

Herbivore

An animal that feeds exclusively on plant material as a food source.

Intertidal

The area of coast which is covered by water at high tide, and uncovered at low tide.

Invertebrate

An animal without a backbone.

Photosynthesis

The process by which light energy is used to create chemical bonds with carbon dioxide and water.

Predator

An organism that catches and kills another organism for food.

Quadrat

A defined area for scientific sampling, and the frame that is used to define this area.

Qualitative

Relating to, measuring, or measured by the quality of something rather than its quantity.

Quantitative

Relating to, measuring, or measured by the quantity of something rather than its quality.

Salinity

A measure of dissolved salt concentration in water.

SCUBA

Self-Contained Underwater Breathing Apparatus.

Sessile

Attached; not free to move about.

Substratum

A base which a sessile animal or plant is fixed.

Subtidal

The area of coast which is covered by water at low tide.

Toxin

A poisonous compound.

Turbidity

The measure of water clarity.

Vagrant

Individual animals of a species that appear well outside their normal range.

General Quality Control Guidelines

- Read up and familiarise yourself with the methods before the day of a survey. If unsure how to implement any of the methods refer to the relevant video clip, or speak to your ranger.
- Take step-by-step instructions with you when you go out into the field, and follow them closely. These are available on the Sea Search website, and from your ranger on the day of an activity.
- All groups doing quadrat sampling should be briefed before starting that one way of ensuring accuracy is for more than one person to count the species and intercept points in each quadrat (from the same position) to make sure they both get the same count.
- At least one person in the volunteer group should be identified as the QC person (this person is likely experienced at the method and familiar with the species).
- Make sure the GPS unit you are using is set to the correct format each time you go out, so you are coming back to the same (randomly assigned) quadrat sites each time. Note that Parks Victoria uses the WGS84 format displayed in Degrees, Minutes and Seconds.
- Ensure all relevant data has been collected (i.e. datasheets should have no gaps). Check you have recorded a complete set of data before moving to the next quadrat, or the next method.
- Have your partner check your data.
- Enter data into the APP/database as soon as possible after the survey has been completed.
- Keep up to date on species ID and take ID guides out into the field as necessary. To improve ID skills attend training courses where available and share your knowledge with others. If unsure about a species write a detailed description and take photos so your ranger can seek the advice of experts in marine taxonomy.
- If you are unsure about anything ask your ranger.

Quality Control Specific to Rocky Shores

- Point intercept counts should not total more than 49 (it may be less as bare rock and sand are not counted). Only the top layer of algae is counted not any understorey.
- If measuring snails and limpets for the detailed intertidal reef methods make sure that the species are correctly identified (e.g. juvenile *Dicathais orbita* may be confused with *Lepsiella vinosa*).
- Spot check between groups (at least once for each group during the event) to make sure everyone is sampling and recording correctly (e.g. point intercept counts are accurate, species are correctly identified, photos are clear and in focus and named accurately).

Quality Control Specific to Seagrass

- Spot check between groups (at least once for each group during the event) to make sure everyone is sampling and recording correctly (e.g. cover composition totals 100%, species are correctly identified, photos are clear and in focus and named accurately).

Notes



