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BEST PRACTICE GUIDELINES

For Removal of Northern Pacific seastars (*Asterias amurensis*) in Port Phillip Bay

2022 Update

Important disclaimer

The contents of this document have been gathered from research of a number of sources, which are referenced throughout this guide. Guidelines written by industry professionals such as the Australian Adventure Activity Standard include information which may not be in this document, and may need to be read in order to fully comprehend this guide.

The best attempt has been made to ensure all information is accurate. However, ***this document should be used only as a guideline for best practice and holds no legal obligations.*** Each *Asterias amurensis* collection site has to be assessed individually to eliminate all risk associated with loss or injury to participants. The Port Phillip EcoCentre and organisations in partnership with this project are not responsible for any personal loss, damage or consequence from unforeseeable incidents not mentioned in this guide.

Contents

Foreword

The 2013 *Best Practice Guide for removal of Northern Pacific seastars (Asterias amurensis) in Port Phillip Bay* (the guide) was made possible with funding from the Federal Government's 'Caring for Country' program. This project drew largely on the ongoing efforts of Earthcare St Kilda removing Northern Pacific seastars (NPS) from St Kilda Harbour since 2004. The project involved liaison and collaborations with numerous stakeholders including Earthcare St Kilda, Parks Victoria, Victorian Department of Environment & Primary Industries, Deakin University, ReefWatch and Polperro Dolphin Swims, as well as community members and marine researchers.

The 2013 version of this guide was compiled by Dean Bird and Neil Blake (OAM), with thanks to Julianne Stuart, Wendy Albury, Emily Verey, Judy Muir, Jason Strugarek, Jeremy Willcox, John Tornatora and Jill Robinson.

The 2022 update of this guide was completed by Fam Charko, Sophie Clarke, Neil Blake (OAM), with thanks to Julianne Stuart and Jacqui Younger.

This work was supported by the Port Phillip Bay Fund, via the Department of Environment, Land, Water and Planning.

VICTORIA
State Government

Purpose of this Guide

This guide has been written to enable local communities to take action to protect local habitats of native species, where infestation by NPS has already occurred. The principles and practical steps in this guide may be adopted and applied in a community or industry setting.

History of *A. amurensis* in Port Phillip Bay

Asterias amurensis was first spotted in Port Phillip Bay in 1995 by a scallop fisherman off Point Cook. NPS originally came from Japan and were introduced to Australia through the ballast water of commercial ships. In the late 1980s they had already established in Tasmania's Derwent Estuary and grown to plague proportions due to the lack of natural predators. Populations are too big to monitor at the time of this publication, but the significant reproduction capacity of *A. amurensis* in Victorian waters suggests they are most definitely in their millions. Adult females are capable of releasing up to 20 million eggs at a time when spawning, which means population growth can easily get out of control.

A. amurensis is a voracious predator that preys on a range of native animals. They prefer mussels, scallops and other bivalves, but will eat pretty much anything, including sea squirts, sponges and other seastars. Through predation and competition for food sources, *A. amurensis* modifies marine ecosystems and threatens native species.

A. amurensis is well established in Port Phillip Bay, meaning any attempts at full eradication are futile. However, protecting our marine assets from marine pests via manual removal is an important management strategy. Research has shown that disrupting the breeding cycle by doing removals in spawning season can make a difference for the population size. Especially fragile conservation areas such as Marine Protected Areas benefit from ongoing marine pest removal; much like weeding a garden, we may not be able to eradicate a weed completely, but we can keep a chosen area weed-free, allowing indigenous species to thrive.

As part of the Invasive Plants and Animals Policy Framework (2010) by the Victorian Government, the Invasive Marine Pests Module was developed in 2022 by the Department of Agriculture. Our guide aligns with the asset-based protection priority *Identify opportunities to reduce the impacts of marine pests in areas where they have already established.* The National Control Plan is a great tool to reference for background information compiled before 2000.

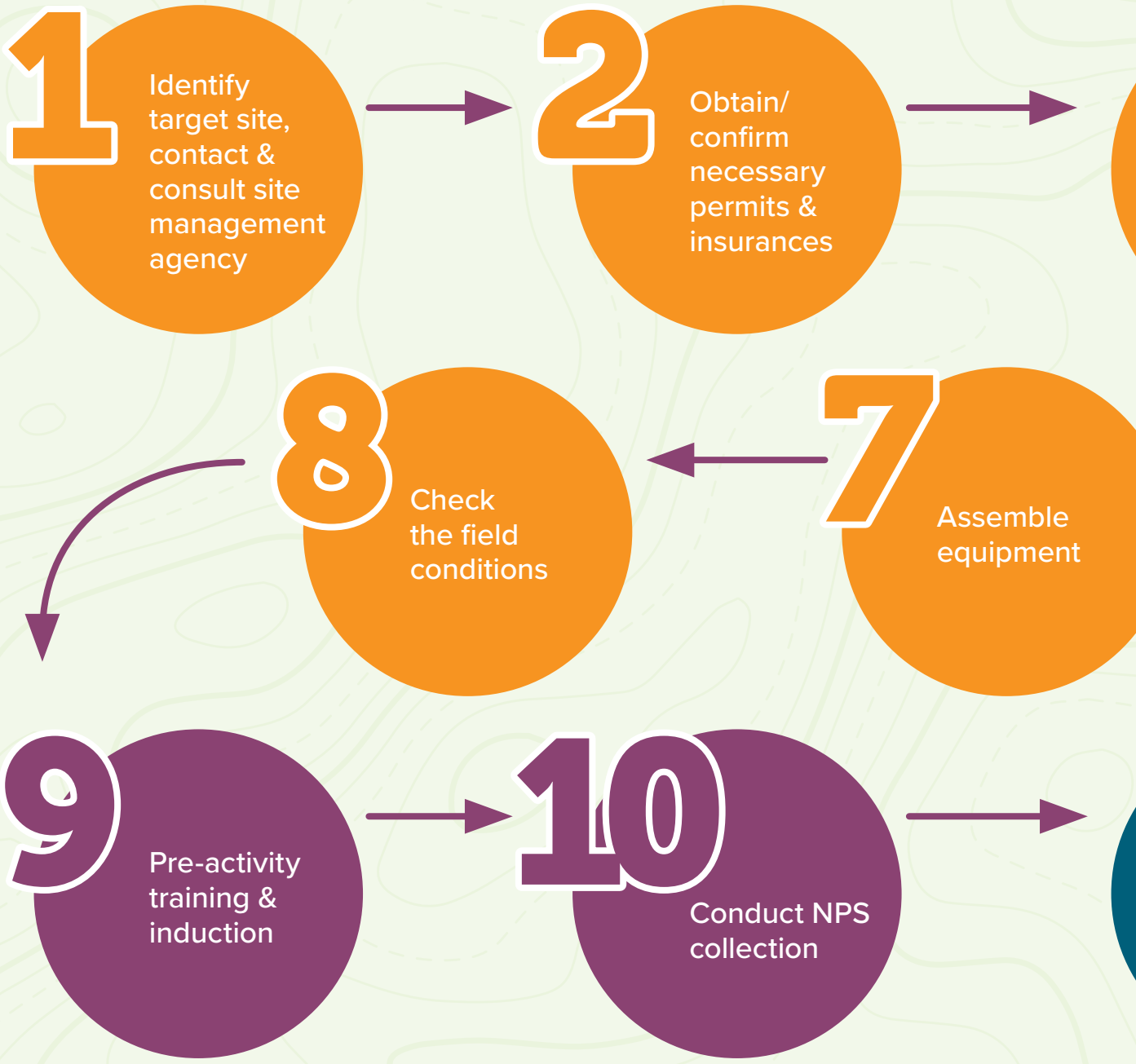
https://agriculture.vic.gov.au/biosecurity/protecting-victoria/legislation-policy-and-permits/invasive-plants-and-animals-policy-framework

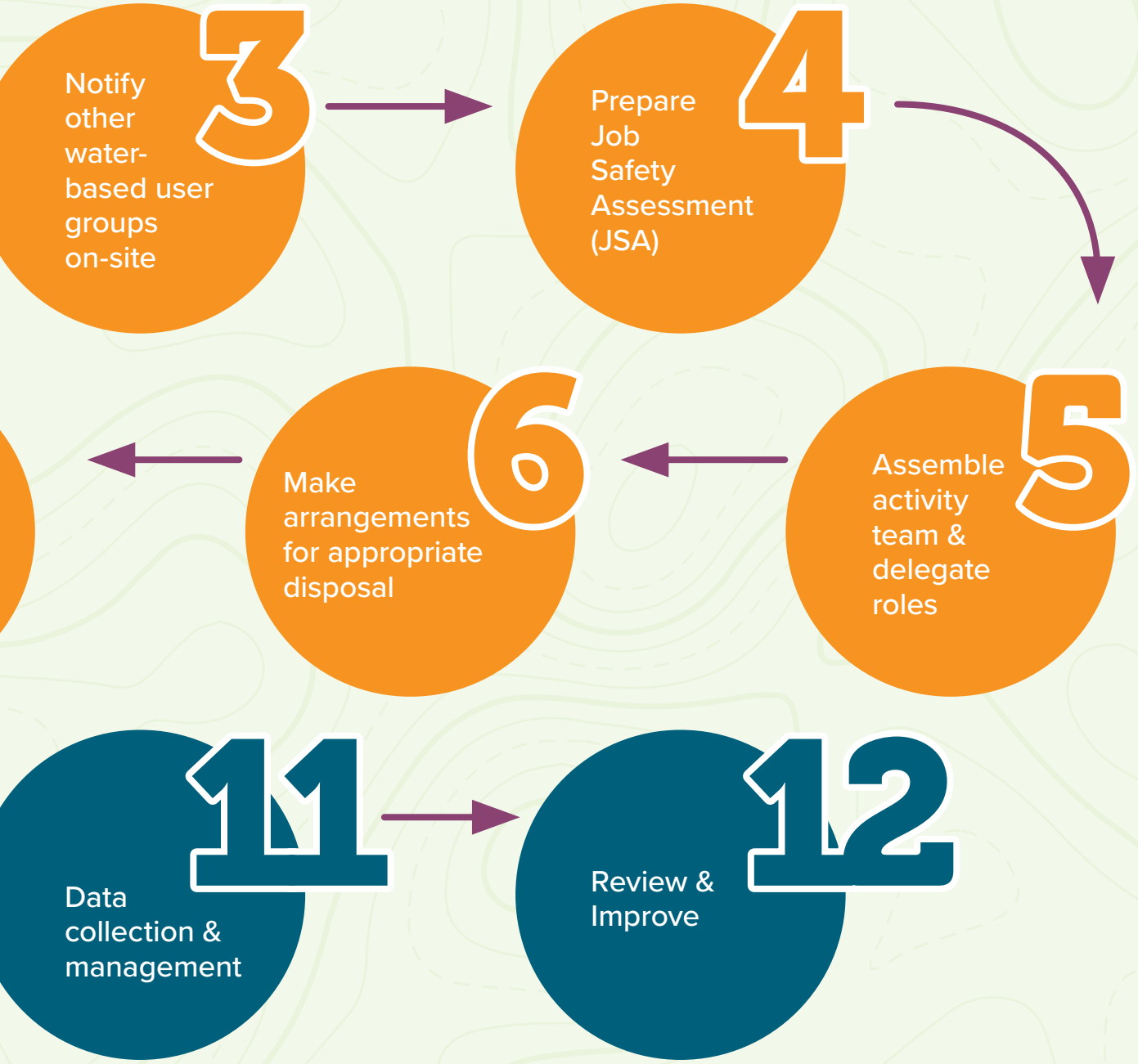
https://www.awe.gov.au/environment/marine/publications/controlling-northern-pacific-seastar-asterias-amurensis-australia

How to use this guide

This guide presents the logical sequence of tasks and considerations required to successfully complete a local cull of *A. amurensis*, as presented in the following flow chart.

Best Practice Guidelines Flowchart




3
Notify other water-based user groups on-site
4
Prepare Job Safety Assessment (JSA)
5
Assemble activity team & delegate roles
6
Make arrangements for appropriate disposal
11
Data collection & management
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Review & Improve

1. Identify Target Site, Contact & Consult with Site Management Agency

Once you've noticed an abundance of *A. amurensis* in a particular habitat and decided you want to take action to protect the area for native species, you'll need to communicate with a range of organisations to enable an effective removal campaign.

Site management agencies

Consult the management agency responsible for the site to ensure you are fully aware of any relevant regulations. They may also be able to assist in providing equipment or advice. When identifying your site, take into account the following information:

- ***Is your site in a Marine Protected Area such as a Marine National Park or Marine Sanctuary?***
  If it is, Parks Victoria is the management agency and will need to be consulted before any removal activities can be undertaken. It is illegal to remove anything from Marine Sanctuaries (including marine pests) without explicit consent from Parks Victoria. They have their own volunteer programs in place, which you can join[1]. Current Marine Protected Areas in the Bay are: Ricketts Point Marine Sanctuary (Beaumaris), Jawbone Marine Sanctuary (Williamstown), Point Cooke Marine Sanctuary and Port Phillip Heads Marine National Park, which contains several protected sites (see Appendix 2 for site management authority details).

- ***Are there any dive/research boundaries or regulations to prevent your activity from happening?***
  Relevant authorities need to be alerted prior to each activity and correspondence maintained after each activity. Authorities may be for example: Parks Victoria, Department of Environment, Land, Water and Planning (DELWP) or the Environment Protection Authority (EPA) Victoria.

[1] https://www.parkconnect.vic.gov.au/Volunteer/

2. Obtain Necessary Permits and Insurances

It is essential to obtain the appropriate permit from relative authorities and site managers.

If you are completing NPS removals as a team, it is sufficient for one team member to obtain a permit and oversee the activities of the team to ensure they are in line with the permit conditions. However, putting multiple team members' names on the permit means that the same permit can be used by multiple people and helps to allow the activity to go ahead if some people can't make it.

Noxious Aquatic Species permit applications are free and are usually valid for up to 3 years from date of issue (subject to the decisions made by the VFA).

Your group is required by law to have a Noxious Aquatic Species Permit, issued by the Victorian Fisheries Authority (VFA), to catch and remove NPS from Victorian waters.

For more information and to apply for a permit, visit *https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria*

3. Notify Other Water-Based User Groups On-Site

It is in your best interest to notify other local groups, especially those that use the waters in the area in which you choose to dive. This is primarily for safety reasons, but also to help raise awareness of your activity and the issues of pest species in Australian waters.

You may even recruit people to help. For example, Royal Melbourne Yacht Squadron and Brighton Sea Baths have offered hot showers to participants of Earthcare Northern Pacific seastar culls. Other groups who may help in some way are local marine care groups, dive clubs, universities, schools, fishermen, local sports clubs and Local Councils.

In some cases, you will find that an existing group is already looking after a particular site, and you might join them for their removal activities rather than having to organise your own. Examples are local dive clubs organising monthly NPS removals around piers and dive sites.

See Appendix 2 for a list of contacts for Marine Sanctuaries.

4.
Job Safety Assessment

A Job Safety Assessment involves considering all aspects of the activity, identifying any associated hazards and suitable measures to eliminate those hazards. In some cases, for legal and practical reasons, some sites may need a Job Safety Assessment to be signed off by the local management agency before any activity occurs. See Appendix 3 for an example Job Safety Assessment.

Volunteer and public liability insurance

Volunteer insurance is essential to protect you, and your volunteers, in the case of any loss and/or injury resulting from the activity. ***Without such cover, injured volunteers would be unable to claim compensation and individuals responsible for organising the activity may be held personally liable.***

Volunteer Insurance is available from various insurance agencies, but be sure to read the 'fine print', as many policies have restrictions – such as age (volunteer under 18) or types of volunteer (e.g. Student/work placement), or activities (including in-water activities) that could impact your volunteer cover. You also need to check if your group needs to be incorporated before being eligible to get cover.

People with professional SCUBA or Snorkel Guiding qualifications, who are in active teaching status and insured via their training agency, can take people out into the water according to their level of training and insurance cover.

Volunteers and the law

Volunteers in Australia have legal rights, which are set out in the National Standards for Volunteer Involvement

https://www.volunteeringvictoria.org.au/wp-content/uploads/2019/06/National-Standards-Document-FINAL.pdf

A useful resource for managing volunteers is the Volunteer Management Toolkit, by Volunteering Victoria.

https://www.volunteeringvictoria.org.au/resources-guides/volunteer-management-toolkit-and-handbook/

Measures to manage risks associated with diving and snorkelling activities are essential to maintain a viable activity into the future. Both organisers and participants must take some responsibility for this. Pairing up snorkelers, divers and waders as 'buddies' who keep an eye out for each other is an essential step to ensure safety in the water.

5. Assemble Activity Team and Delegate Roles

To ensure volunteers are well briefed and a successful and risk free activity is achieved it is important to have a coordinating team with clearly understood responsibilities. Don't expect any one person to take responsibility for more tasks than they can reasonably achieve. Your organising team will ideally comprise at least 4 people to cover the following:

- Overall Activity Coordinator
- Safety Observer
- Data collection researcher
- Public relations and volunteer amenities person

All members of the organising team should read and understand their role description and the Job Safety Assessment (Appendix 3). See Appendix 4 for role descriptions for each of the above.

Induction and training of volunteers

In an ideal world all participants in pest seastar removals would be given a comprehensive training and presentation of the activity, with the opportunity for discussion and question time some time before the day of the activity. The reality is that many people hear about the event and turn up on the day. Induction and training of all participants immediately prior to the activity should include:

- Signing an 'Assumption of risk, waiver of liability and indemnity agreement' before commencing, depending on the insurance conditions set by the insurer of the activity (this can often be incorporated into the volunteer sign-in attendance sheet)
- A brief explanation of the purpose of the pest removal
- What each participant is expected to do
- Correct identification of Northern Pacific seastars and similar native seastars
  - Waterproof identification cards[2] (laminated photo-cards, with physical characteristics) are often available for new volunteers from various sources.
- Safe work methods
  - Participants are to be competent in snorkelling and swimming ability, if entering the water.
  - All coordinating team members, divers and snorkelers are to have and understand a set of communicative hand signals (see Appendix 1).
  - Waders need to be proficient in the safe use of waders in water.
  - Participants are to be briefed with a pre-activity safety briefing.
- Collection and disposal methods
  - Members are able to correctly identify native seastars and distinguish them from *A. amurensis*.

[2] **Download the Victorian Marine Pest Deck:** *https://www.ecocentre.com/programs/community-programs/baykeeper/community-rapid-response-teams/*

6.
Make Arrangements for Appropriate Disposal

In the case of very large volumes of NPS, it is wise to contact the relevant Council ***before*** the planned removal activity, to ask for assistance with waste removal. Contact can be made with the Council's foreshore managers, or someone from their waste department, to provide extra bins, or for an extra bin pickup after the activity.

Sizing sheet to easily measure and count NPS

7. Assemble Equipment

Appropriate equipment is essential to efficiently catch and dispose of pest seastars in safe conditions. While some equipment (such as first aid kits) may rarely be required, they will be sorely missed should the need arise! The equipment listed here are *essential items*.

Activity Coordinator + Safety Observer (collectively)

- ☐ Best Practice Guidelines for removal of Northern Pacific seastar (*Asterias amurensis*)
- ☐ 'Diver in water' flag
- ☐ Air horn or whistle for Safety Observer to alert boats of divers/snorkelers – or to contact divers/snorkelers in water
- ☐ First aid kit
- ☐ Indemnity Forms and Participant Medical Forms, where required by your insurer (including emergency contact details)
- ☐ Appropriate permits (see section 2 above for further details)
- ☐ Seastar identification resources
- ☐ Catch bags
- ☐ Wheelie bins or tubs for freshwater immersion and ultimate disposal of pest seastars
- ☐ Pencil and clip-board with diver/snorkeler record sheet noting water entry and exit time of each diver/snorkeler spent in water and consequently hypothermic symptoms (Safety Observer needs to be extra vigilant of hypothermic symptoms).
- ☐ Weather-appropriate personal clothing and sunscreen
- ☐ Warm drinks and snacks for volunteers

Divers/Snorkelers/Waders

- ☐ Wetsuit (see wetsuit guide below) or fishing waders when land-based
- ☐ Mask and snorkel
- ☐ Gloves and hood
- ☐ Fins or appropriate protective footwear – i.e. reef shoes, booties etc.
- ☐ Catch bag or other practical means of collecting seastars in the water (e.g. a plastic tub on a floating boogie board you can pull along).
- ☐ Whistle to alert boats in high-traffic areas

Data Collector(s)

- ☐ 4 large buckets (numbered) to queue seastars waiting to be processed
- ☐ Sizing sheet (2m X 2m plastic tarp with size gradations marked on it, pictured on page 12)
- ☐ Weight scale (if collecting data on kilos collected)
- ☐ Camera
- ☐ Stationery for data collection (clipboard, data sheets, pencil rather than pen for wet conditions)

Public Relations & Community Education Officer

- ☐ Weather-appropriate personal clothing
- ☐ Information booklets/brochures/fact sheet with information about "What are we doing"; "How to get involved", etc.

Optional Gear

- ☐ Waterproof camera for divers/snorkelers use in underwater habitat assessment and for citizen science data recording.

Wetsuit guide

For Temperate Victorian waters (9°-25°C), *a good quality wetsuit is imperative*. In choosing a wetsuit, we have to consider size, water temperature, wind, cold sensitivity and activity levels.

Size - If the neck of the suit is too tight it could restrict blood flow to the brain. If it is too big, it will not insulate properly.

Water temperature - Direct contact with water (conduction) pulls heat away from the body 25 times faster than air, because water has a greater density (therefore a greater heat absorption capacity). You can use the chart below as a guide. However, consider the following variables carefully.

Wind - Wind strength and direction play a major part in changing the water surface temperatures. The Safety Observer and Lead Diver will need to monitor the changes in the wind throughout the dive. The amount of 'chop' on the surface with the onset of increased wind will also affect snorkelling conditions and possibly the underwater visibility.

Activity levels - Snorkelling and diving are not the most strenuous of activities, especially when collecting seastars. Therefore a thicker wetsuit (than what you would surf in for example) is important to keep the core body temperature warm and comfortable.

Cold sensitivity - Individual tolerances to cold vary. Aim to be a little warm instead of a little cold.

Surface water temperature	Minimum thickness recommendation for wetsuits*
10 < 13 °C	6/5/4 mm
13 < 16°C	5/4mm
16 < 19°C	4/3mm
19 < 22 °C	3/2mm

*based on a diver in the water for 90 min or longer.

1. START YOUR DIVE WARM
   Before you even step into a wetsuit, make sure your core body temp is toasty. It's much easier to warm up when you are dry!
2. GET YOUR HOOD ON
   Changes in surface temperature and wind can dramatically affect heat loss through convection. A hood makes a big difference.
3. HOW GOOD IS YOUR SUIT?
   Make sure it fits well and doesn't have any leaks!

8. Check Field Conditions

Environmental factors – when to dive/snorkel?

Environmental factors are a major influence on whether the activity can be conducted safely or not, and also influence the efficiency and effectiveness of the activity. Activities should be called off whenever conditions are likely to compromise safety (see Appendix 3 – Example Job Safety Assessment). The Lead Diver should conduct a pre-activity safety assessment including the following:

Weather (particularly winds)

Prevailing winds can vary greatly from day to day and with each site. A 'choppy' wind-affected surface makes snorkelling difficult and in shallow waters the seabed may be churned up by the turbulence, creating poor visibility.

Tides and currents

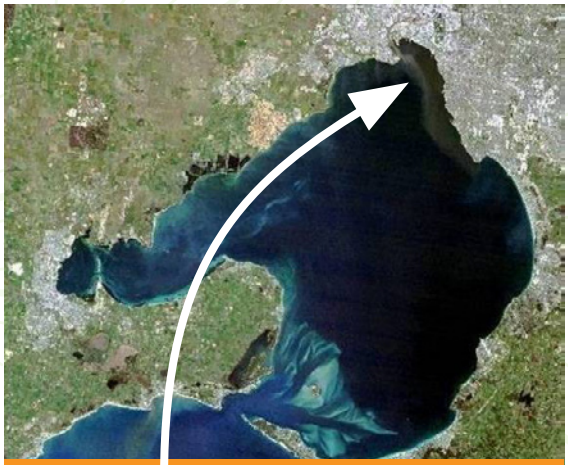
Timing the collection around low tide maximises the area that can be effectively covered by pest seastar collectors. Tidal streams should be considered in the south of the Bay where ebb tide currents are quite strong. Check the Bureau of Meteorology website for local tide times.

Changes in wind strength and direction affect local wave action. If the site is not protected from wave action, a 'swell report' is necessary to check predicted changes to water conditions. Waves can significantly impact on diver safety in a pier break wall site, which are hard and quite often encrusted in barnacles. In the picture on the left, whilst it's a pretty good day for snorkelling at St Kilda Pier, a change in wind direction could result in the diver being forced onto the mollusc-encrusted pylons.

Rainfall

Heavy rain can increase turbidity due to mud and organic matter being washed into the Bay from waterways and drains. This can dramatically decrease the ability to see/find the target seastars, as well as water quality. Swimming in polluted water may lead to illness.

- Access the EPA Summer water quality Beach Report here: *https://www.epa.vic.gov.au/for-community/summer-water-quality/beach-report*
- Subscribe to beach forecast SMS notifications here: *https://www.vision6.com.au/em/forms/subscribe.hp?db=557260&s=246483&a=18211&k=8a7851b*



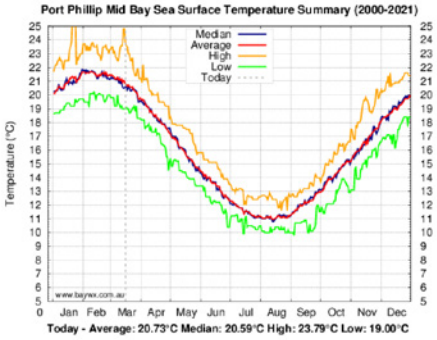
In this satellite image of Port Phillip Bay (taken after heavy rains) you can clearly see the plume of brown river water mixing with the waters of the Bay along the north-eastern coastline.

[3] *http://www.bom.gov.au/oceanography/projects/ntc/3 vic_tide_tables.shtml*

Water temperature

Monthly average surface water temperatures in Port Phillip Bay since 2000 are found in the graph below. These results are relevant for diving/ snorkelling preparation, but also for predicting the *A. amurensis* spawning cycle.

Source: *http://www.baywx.com.au/baytempsav.html*



9. *Asterias amurensis* Spawning Cycle

Strategic concentration of 'catch effort' for removal of *A. amurensis* may play a vital part in their control. The most opportune time to conduct removals would be during April - June when they tend to move closer to shore and are therefore most accessible to land-based removal. Also, this period precedes the seastars spawning and removal of the adults will eliminate the larvae that would have been spawned. Since 2018, spontaneous mass aggregation events of thousands of NPS have been recorded on beaches and around piers, including at Mordialloc Pier, Kerferd Pier, Mornington Pier, Mt Martha, McCrae, Dromana and other beaches. These aggregations have generally been recorded between the months of April and August, although some occurred over summer.

There are correlations between water temperatures and spawning periods. In the report compiled by the State of Victoria, Department of Sustainability and Environment in 2004, *Controlling the Northern Pacific seastar (Asterias amurensis) in Australia*[4], they found a prevalence of NPS larvae at three sites in Port Phillip Bay, between the 29th May and 30th October. They conclude: "*Spawning is therefore likely to have occurred in early to mid-May with a larval duration to early November*".

In considering the water temperatures from May to November in the above graph it is apparent that *A. amurensis* spawn in Port Phillip Bay when the water temperature is around 17 degrees or below.

However, in the last few years, mass aggregations have occurred in November to March as well. The exact cause of this is unclear, but there is a chance this has to do with the potential adaptation of NPS to increased water temperatures.

Pre-activity training and induction

Correct identification of seastars

All participants involved in removal of NPS in Australian waters need to know how to correctly identify this pest species and to never confuse them with native species of Australian seastars. Above is a brief summary of the characteristics of *A. amurensis*[5].

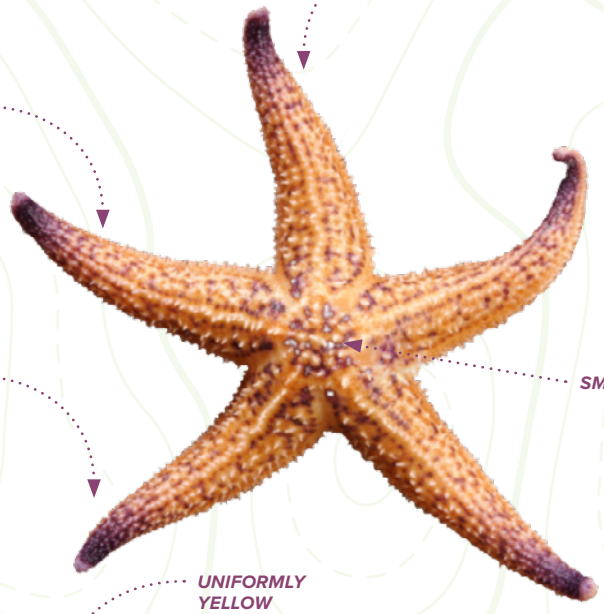
Waterproof identification cards (laminated photo-cards, with physical characteristics) can be made available for new volunteers.

In Port Phillip Bay NPS usually have 5 arms, although some have been found with only two or three due to sustaining damage. The arms have irregularly arranged spines along them and pointed tips, which are often turned upwards. The arms join into a central disc. Colours of the upper surface can vary from yellow and orange with purple shading. The underside is uniformly yellow.

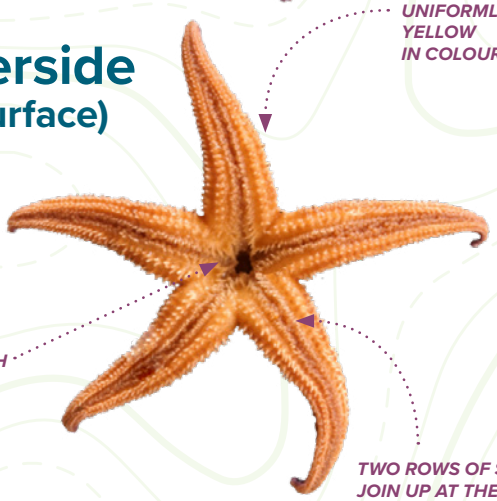
Important note More than one of the characteristics mentioned above must be checked off in order to be certain that what you are looking at is, in fact, *A. amurensis*.
Never rely on colour alone!

[4] *https://www.awe.gov.au/sites/default/files/documents/pacific-seastar.pdf* [5] *https://nimpis.marinepests.gov.au/species/species/105*

Upper Surface



Underside
(oral surface)



Examples of some different colour variations of *A. amurensis*. Picture by Earthcare St Kilda

Key Flow Chart for Sea Star Identification

SEA STAR

6 OR MORE ARMS

5 OR LESS ARMS

11 ARMED SEA STAR

Coscinasterias calamaria

8 ARMED SEA STAR

Meridiastra calcar

NOT YELLOW, ORANGE OR PURPLE IN COLOUR

YELLOW, ORANGE OR PURPLE IN COLOUR

NON-DISTINCT ARMS WITH LARGE CENTRAL DISK

DISTINCT ARMS THAT JOIN AT A SMALL CENTRAL DISK

SMALL GREEN SEA STAR

Parvulastra exigua

VERMILLION SEA STAR

Pentagonaster duebeni

BISCUIT STAR

Tosia magnifica

TIPS OF THE ARMS ARE FLAT AND ROUNDED

TIPS OF THE ARMS ARE POINTED AND UPTURNED

GRANULAR SEA STAR

Uniophora granifera

OCELLATE SEASTAR

Nectria ocellata

MANY SPOTTED SEASTAR

Fromia polypora

NORTHERN PACIFIC SEA STAR

Asterias amurensis

Wasting disease in Native seastars

Wasting disease is an umbrella term for a set of symptoms that are found in seastars and can cause mass mortality events. The causes of wasting disease are unclear, however wasting events are commonly associated with abnormally high water temperatures. A seastar wasting event was observed in Port Phillip Bay in 2015 from September–December.

Signs of wasting disease

Participants involved in NPS removal should know the signs of wasting disease in native seastars. This could allow wasting events to be reported and addressed sooner. Symptoms are:

- Lesions on the surface of seastar
- Tissue decay around lesions
- 'Floppy' arms and loss of strength
- Loss of limbs
- Swelling
- Seastar death

Reporting wasting disease

If you see a seastar (native or invasive) with signs of wasting disease, please take detailed photos and email them, with the date and exact location to:

1) Port Phillip Baykeeper:
baykeeper@ecocentre.com

and

2A) Parks Victoria:
info@parks.vic.gov.au
if wasting disease-affected seastars are found in Marine Protected Areas

or

2B) Department of Environment, Land, Water and Planning, if found anywhere else in Victorian water by calling 1800 675 888 or via this webpage: *https://agriculture.vic.gov.au/farm-management/emergency-management/biosecurity-emergencies/report-a-biosecurity-incident*

Two seastars from Canada, affected by wasting disease. Note the lesions, 'floppy' limbs and loss of limbs. Photos: Jonathan Martin

10.
Conduct NPS collection

Equipment to pick up NPS will vary depending on the location and collector, and the conditions listed on the permit by the Victorian Fisheries Authority. People wading in shallow waters can use long-armed tongs (as used to pick up litter) and a catch bag. Snorkelers and divers may prefer to collect and place the pests into a catch bag with gloved hands.

There is no apparent physical human threat to removing these animals by hand, however wearing gloves is highly recommended.

A. amurensis is a declared noxious species in Victoria and regulations are set by the Department of Jobs, Precincts and Regions (DJPR) to control handling of these animals.

"Once declared as noxious, people must not bring these species into the state, nor take, hatch, keep, possess, sell, transport, put into any container or release into protected waters any declared noxious aquatic species (unless otherwise authorised by permit)."

The Victorian Fisheries Authority has a hotline for any witness of an offence relating to noxious aquatic species (such as keeping or selling these pests) to report on 13-FISH (13 3474).

For more information on Noxious Aquatic Species in Victoria or the Fisheries Act visit the website:

https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria

https://agriculture.vic.gov.au/biosecurity/marine-pests

Ethical and responsible disposal

Removing NPS from the water is not the only part of a clean-up that is important. Paying attention to ensure they are dead and disposed well away from waterways is just as important as catching them. They should be taken to landfill or composted. Ensure there are no traces of larvae or eggs on any equipment (see next section on cleaning equipment).

1) Wheelie bins are sturdy containers which can be moved easily. Make sure the bin is secure so the contents can't be spilled back into the Bay!
2) Wheel your collection to a point away from the water and fill it with *fresh* water, if available, and submerge the seastars for a minimum of 15 minutes.
3) Ideally, your bin will be plumbed with a tap at the base to drain water away after at least 15 minutes. Otherwise, tip the contents out *on land well beyond the high tide line and away from any storm water drains*. If no fresh water is available, it is acceptable to let them dry out.
4) Approach your local Council for collection beforehand if quantities are large (such as in case of a mass aggregation). See Appendix 2 for Council details. Smaller quantities can be disposed in your garbage bin or compost. When composting at home, sprinkle some garden lime (rock powder) over them to reduce the smell.

Alternatively, freezing is considered the most 'humane' way to euthanize pest seastars, if you have access to enough freezer space.

Cleaning your equipment

As our aim is to control the spread of *A. amurensis* in Australian waters we must ensure our actions don't unintentionally transport larvae or eggs to other waters.

Proper cleaning of all equipment ensures no transfer of eggs or larvae into other waters.

'Proper' cleaning involves:

- Designate a 'cleaning' area *away from stormwater drains* to ensure no larvae or remnants of pest seastars can get washed into the drainage systems, and therefore get possibly redirected back into the marine environment.
- Have a watertight bucket for immersion of equipment (not the same one you used for collection!), making sure that they are cleaned, inside and out. Ideally, soak all your gear with fresh water, which will destroy sea life if submerged for long enough.
- The 'cleaning' water can then be spread on plants or grass to absorb into the earth or be exposed to UV from the sun. *Ensure that this water does not go into the gutter or the drain.*
- Be mindful of needing to clean gear before switching waterways. E.g: if you're attending a NPS clean up event in the morning in Port Phillip Bay, and you want to use the same wetsuit to go for a surf ouside of the Bay in the afternoon, make sure you thoroughly clean it before your surf.

https://agriculture.vic.gov.au/biosecurity/marine-pests/how-boat-owners-can-help-stop-the-spread-of-marine-pests

Parks Victoria has a simple Check. Clean. Dry. plan to help stop the spread of marine pests via vessels in Victoria:

CHECK your vessel and equipment for any attached animals and plants — remove them. Do not return marine pests to the water.

CLEAN your vessel and equipment after use with freshwater.

DRY your vessel and equipment thoroughly before moving to a new location.

WHATEVER YOU DO....
DO NOT CHOP UP *A. AMURENSIS* AND THROW THEM BACK!

In 1993 a few organised culls were undertaken in Tasmania's Derwent River. Over 30,000 *A. amurensis* were captured and cut into pieces and thrown back into the water. It wasn't known at the time that these resilient seastars have the ability to regrow a whole body if they have some part of the central disc remaining.

Numbers grew exponentially after their multiplication.

11. Data Collection and Community Engagement

Citizen science

Collection of accurate data on the number and size of NPS removed during each removal, and the habitats they were found in is invaluable to better understand their biology and behaviour in Port Phillip Bay. It may give us clues as to how to most effectively reduce their numbers over time, and predict where and when mass aggregations could happen.

High-quality citizen science data also enables the effectiveness of removals to be assessed and can inform decisions to improve the removal method if necessary.

If you collect data, use the data sheet in Appendix 5. Please make sure it is as accurate as possible (especially locations, dates and numbers of NPS removed) and send it to the Port Phillip Baykeeper at *baykeeper@ecocentre.com*.

Communication & community education

It is highly desirable for all participants (and non-participants) to understand the reason for NPS removals and the best practice methods discussed in this Guide. This is why it is important that one of the team members is the designated Public Relations Officer.

According to a 2017 report by the Department of Agriculture and Water Resources, of all States and Territories in Australia, Victorians were the least likely to recognise or report marine invasive species, and are the most likely to do nothing if they saw a suspected pest[6].

Education about marine invasive species is necessary at all levels within the community - including environmental groups and authorities - to ensure proper understanding during the hands-on experience of marine conservation.

Information that could be provided to different audiences is:

Community Groups

- Seastar identification guides, such as the Marine Pest Deck, the resources in this Guide, and other community education resources offered by DJPR, VFA, DELWP and Parks Victoria.
- Appropriate and accessible websites, including FAQ's.
- Contact details of relevant management agencies and government departments.

Authorities and Environmental Groups

- Citizen science results (properly analysed and worked into reports) to be made available to such groups to inform future planning and collaboration.

Education Providers (Schools, TAFE and Universities)

- Demonstrating methods of physical removal of seastars, locations targeted, and citizen science data collection methods. Research efforts should be maintained over the longer term to enable clearer analysis and conclusions to be drawn on effectiveness of removals.
- Pest seastar removals are a great basis for 'out-of-classroom' maths and science, and an interesting way to get school children to engage with their local environment and community.

The Public (on-site)

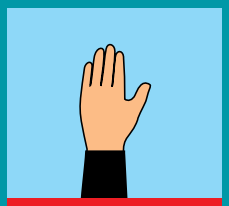
- Friendly chats with the designated Public Relations Officer when people have questions. Passers-by will be curious about your activity. Some may just stare, but others will ask! Ensure that you are polite and informative. They may become a volunteer, or know someone who could support the activity.
- Flyers or posters with information about the activity, including QR codes that can take people to relevant websites and organisations that promote community awareness and participation.

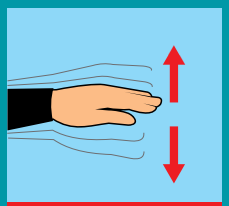
[6] Marine Pest Surveillance Observer Groups – Knowledge, reporting behaviour and required education and awareness resources (2017) Department of Agriculture and Water Resources

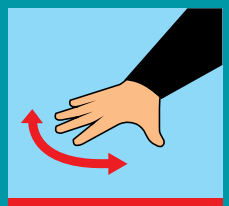
Appendix 1

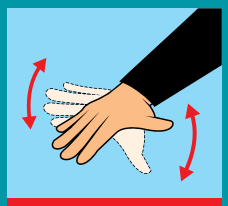
SCUBA HAND SIGNALS

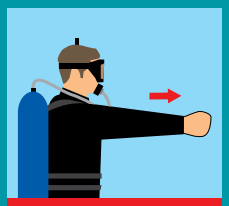
These are the hand signals that are used by scuba divers to communicate with each other. It is always a good idea to review these signals with your dive buddy prior to your dive to prevent misunderstandings and mistakes.

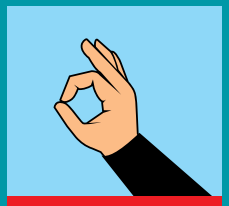

Stop / Hold it / Stay there

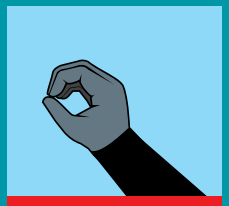

Take it easy / Slow down

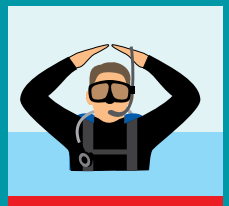

Level off / How deep?

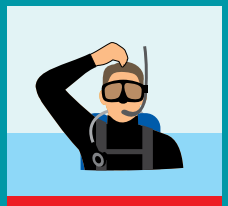

Something is wrong

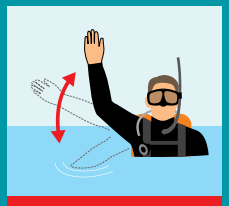

Danger


I am okay / Are you okay?

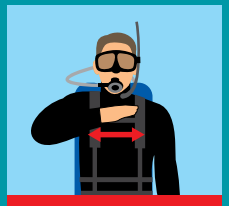

I am okay / Are you okay? (glove on)

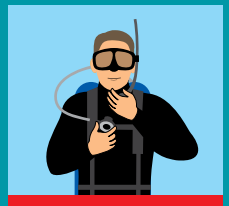

Okay (on surface at distance)

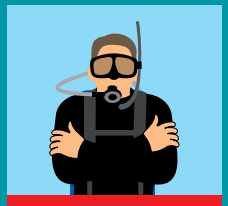

Okay (one hand occupied)

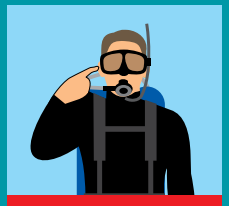

Distress / Help

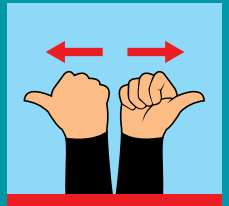

I'm low on air


I'm out of air

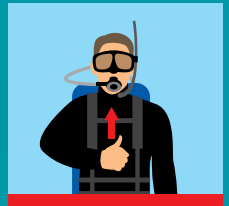

I need to buddy breathe

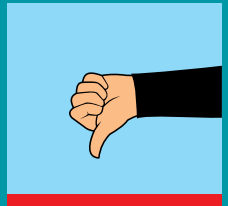

I am cold


Ear trouble

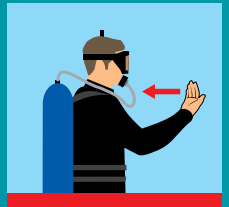

Which direction?

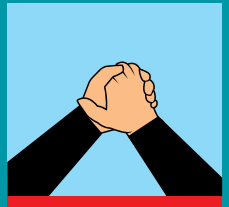

Go that way

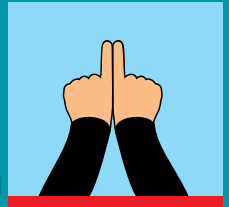

Go up / Going up


Go down / Going down

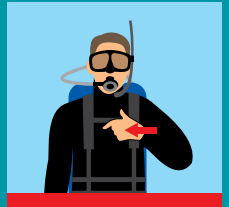

Under / Over / Around


Come here


Hold Hands


Get with your buddy


You lead, I will follow


Me / Watch me

Appendix 2

Council details

Council	Phone	Email
Bayside	(03) 9599 4444	*enquiries@bayside.vic.gov.au*
Frankston	1300 322 322	*info@frankston.vic.gov.au*
Greater Geelong	(03) 5272 5272	*contactus@geelongcity.vic.gov.au*
Hobsons Bay	(03) 9932 1000	*customerservice@hobsonsbay.vic.gov.au*
Kingston	1300 653 356	*info@kingston.vic.gov.au*
Melbourne	(03) 9658 9658	*http://www.melbourne.vic.gov.au/contactus*
Mornington Peninsula	1300 850 600	*customerservice@mornpen.vic.gov.au*
Port Phillip	(03) 9209 6777	*assist@portphillip.vic.gov.au*
Queenscliffe	(03) 5258 1377	*info@queenscliffe.vic.gov.au*
Wyndham	(03) 9742 0777	*mail@wyndham.vic.gov.au*

https://www.viccouncils.asn.au/find-your-council/council-map

Site management agency details

Site Management Agencies	Contact
Ricketts Point Marine Sanctuary (Beaumaris)	Marine Care Ricketts Point, *info@marinecare.org.au* OR call Parks Victoria on 13 19 63 or email *info@parks.vic.gov.au*
Jawbone Marine Sanctuary (Williamstown)	Jawbone Marine Sanctuary Care Group: *jawbonemarinesanctuary@gmail.com* OR call the Ranger at Parks Victoria, Williamstown on (03) 9393 9255
Point Cooke Marine Sanctuary	Marine Care Point Cooke, *marinecarepointcooke@gmail.com* OR Parks Victoria Point Cooke Office Phone: (03) 9394 9100
Port Phillip Heads Marine National Park	Call Parks Victoria on 13 19 63 OR email *info@parks.vic.gov.au*

Appendix 3

Job safety analysis – Northern Pacific seastar removal

Beach/Marine Park/Location: **Local Council Area:**	**Project:**
Volunteer Activity/Task: Northern Pacific seastar (NPS) removal	**JSA Prepared by:** Fam Charko **Staff/Group Member consulted:** Neil Blake
Activity Date: / **Date of JSA:** July 2022	
Staff/Volunteer Team Leader:	

Item	Job step Break the job down into steps.	Potential Hazard What can harm you?	Risk Level 0-5	Controls What you are going to do to make the job as safe as reasonably practicable.	New Risk Level 0-5	Person Ensuring Controls Are Implemented
1	Transport to site by foot	Fall/slip	2	• Ensure weather conditions OK for safe walking on piers and Ask volunteers to wear sturdy, closed footwear beforehand • Warn volunteers to look where they are going on the day	1	Team Leader
		Fatigue	2	• Encourage frequent rest breaks • Use trolleys to carry equipment	0	Team Leader
2	Identify local hazards in worksite	Fall/slip on pier or on the rocks	4	• Watch out for changes in surface • Wear suitable, sturdy footwear • Don't walk on rocks when they are wet	1	Team Leader
		Cuts/infection from soil buried glass, metal objects, fish hooks, **sharps**.	4	• Wear gloves when picking up NPS • Warn that this site may contain litter and sharp objects buried in the soil • *Instruct not to put hands where they cannot be seen* • Option to use tongs	1	Team Leader
		Plant scratches	1	• Wear long sleeves, long pants, gloves and eye protection where appropriate • Handle scratchy plants with care	1	Everyone
		Spider, centipedes and other insect bites	2	• Keep a good lookout/avoid • Advise others if you come across an ants nest or poisonous spider	0	Everyone
	Identify local hazards in worksite	Blue-ringed octopus	3	• *Never put fingers when you can't see them*, e.g. under rock ledges • Wear gloves and closed footwear • Do not turn over rocks • If sighted, warn others and avoid the area	1	Everyone

Item	Job step Break the job down into steps.	Potential Hazard What can harm you?	Risk Level 0-5	Controls What you are going to do to make the job as safe as reasonably practicable.	New Risk Level 0-5	Person Ensuring Controls Are Implemented
2	Identify local hazards in worksite	Stingrays	3	• Wear closed footwear • 'Shuffle' feet when wading into the water, so ray can get away rather than being stepped on	1	Everyone
		Sunburn/ UV exposure	4	• Instruct volunteers to wear protective clothing, hat, sunscreen • Instruct volunteers to bring a water bottle and keep fluids up • Take frequent rest breaks • Don't zip up wetsuit until right before entering the water	2	Team Leader/ Safety Observer
		Getting cold/wet	4	• Instruct volunteers to bring rain/wind jacket and warm jumper beforehand • Wear appropriate wetsuit • Advise volunteers to bring set of dry clothes • Seek shelter if things get too wet • Encourage volunteers to speak up when they are cold • Monitor for symptoms of hypothermia	2	Team Leader/ Safety Observer
		Fatigue	2	• Ensure regular rest breaks • Drink plenty of water • Monitor participants for signs of fatigue	1	Team Leader
		Volunteers come unprepared for the work	3	• When doing a volunteer call out, email volunteers beforehand with a list of things to bring • Have some spare items on-site (e.g. sunscreen, gloves) • If volunteers don't have the required in-water safety gear, allocate them a task that doesn't require it (e.g. no closed footwear, or too thin wetsuit? Allocate shore-based task such as measuring/weighing the catch).	0	Team Leader/ Safety Observer
	Identify local hazards in worksite	Induct volunteers onto site		• Include OH&S in each introduction: - Hazardous areas where we are not going - Who is first aid officer - Where is first aid kit - Toilets where there is soap and clean water • Work site for the day	1	Team Leader
		Unfavourable Weather conditions	4	• Activity will be cancelled or shortened if: - There are thunderstorms - Wind speeds are unsafe - Temperature is over 34 degrees Celsius - Weather is unsafe for in-water activities	2	Team Leader/ Safety Observer

Item	Job step Break the job down into steps.	Potential Hazard What can harm you?	Risk Level 0-5	Controls What you are going to do to make the job as safe as reasonably practicable.	New Risk Level 0-5	Person Ensuring Controls Are Implemented
2	Identify local hazards in worksite	Unfavourable Air Quality	2	• Check air quality forecast day before • If AQI 'Poor/Unhealthy for Sensitive Groups', notify or cancel volunteers under 18 or over 65. • If AQU 'Very Poor/Unhealthy' or 'Hazardous/ Unhealthy', cancel activity	1	Team Leader
		Boat traffic in area	4	• Use dive flag • Have air horn or whistle on hand to alert snorkelers /divers and boats • Stick to areas where diving/snorkelling is allowed (check individual pier and marina guidelines)	1	Safety Observer
3	Moving and lifting	Repetitive strain injuries	2	• Rotate tasks to avoid repetitive strain injuries or working in an unsound bio-mechanical position	1	Team Leader
		Back strain, manual handling injury	4	• Advise of correct lifting techniques – bend knees rather than back • Keep loads light for ease of lifting • Work together when something is heavy • Use gloves where necessary	1	Team Leader
4	People	Volunteer missing	2	• Keep track of volunteers who go to the toilet • Do head count after returning to site from breaks	1	Team Leader
		Snorkeler/diver missing	3	• Check everyone's diving qualifications beforehand • Cap numbers of in-water volunteers to ensure workable conditions for Safety Observer(s) • Do a safety briefing before activity, incl max dive time, no-go areas, watch for vessels, etc • Enforce buddy system • Register everyone entering and exiting the water, incl noting down enter and exit times • Always keep your eye on the people in the water • Headcount every 30 minutes at minimum • Keep watch for vessel traffic and alert boaters of people in the water with air horn when necessary	1	Safety Observer
		Aggressive member of the public	2	• Team Leader to tell volunteers to move away to a safe spot • Call 000 for police	1	Team Leader

List of training requirements of staff/volunteers undertaking work:

Minimum of 1 qualified First Aider must be present.

Appendix 4

Activity Coordinator

Must be physically fit for duties without risk to themselves or others; be an experienced snorkeler and assessor of marine hazards and snorkeler competence and be qualified to instruct and rescue a snorkeler and administer first aid.

Key responsibilities

1. Plan, assess, and document Dive Plan and JSA for each site snorkelling site and ensure all participants are familiar with and understand the Dive Plan and are suitably experienced and equipped to fulfill their designated role.
2. Plan date and time for each snorkelling activity and liaise with the local land management agency and relevant boating community to confirm plans.
3. Oversee each snorkelling activity to ensure all participants adhere to the Dive Plan and safe work practices.

Specific duties

- Complete a snorkel plan and familiarise all participants with it prior to snorkelling activity;
- Instruct, train and advise snorkelers, including ensuring all participants are given a pre-snorkel briefing;
- Enter the water to instruct, guide and supervise from that position if required;
- Conduct an environmental assessment of the snorkelling site;
- Cancel or modify the conduct of the snorkelling where existing control measures mean it cannot be conducted safely;
- Remain at the snorkelling site to control the overall operation and ensure all control measures are implemented;
- Work as a Team Leader, supervise and consult with other snorkelling participants;
- Assist team members as required, including Safety Observer, Rescue and First Aid;
- Ensure prospective snorkelers complete any required documentation, such as medical statements;
- Assess the competence and fitness of prospective snorkelers;
- Ensure there are sufficient people to be guides, lookouts, rescuers and first aiders;
- Ensure snorkelers are appropriately equipped;
- Ensure equipment, plans and personnel are available for emergencies;
- Ensure snorkelers work in ‘buddy’ pairs;
- Ensure a head count is conducted as required;
- Ensure all injuries and incidents are recorded and reported;
- Ensure all trip documentation is returned to the place of business

Safety Observer

Must be physically fit for duties without risk to themselves or others; be an experienced snorkeler and assessor of marine hazards and snorkeler competence; and be qualified to instruct and rescue a snorkeler and administer first aid.

Reports to the Activity Coordinator.

Key responsibilities:

1. Oversees maximum 15 persons.
2. Responsible for maintaining a close watch on waders and snorkelers, the snorkelling site and any on-water activity in the vicinity of the site.
3. Responsible for ensuring 'Diver Below' flags are deployed and delivering effective warning to boats whenever necessary.
4. Responsible for implementing the relevant safety control measures, monitoring condition of waders and divers each time they return to shore, and assisting the Activity Coordinator to maintain the Dive Plan log.

Specific duties:

- The Safety Observer shall wear distinctive, brightly coloured clothing and be equipped with binoculars, polarised sunglasses, mobile phone, and marine whistle so that effective communication can be made with the Activity Coordinator and any people or boats in the water.
- Conduct an initial appraisal of the seabed substrate in the search area to identify any high risk or sensitive habitat areas eg. seagrass meadows.
- Be located in an elevated position providing a clear view of the entire site;
- Be solely engaged in being the lookout whenever people are in the water, unless engaged in an emergency response;
- Assist other workers as required, including rescue and first aid;
- Request assistance if needed;
- Recognise and report relevant hazards eg. changing conditions, to the Activity Coordinator;
- Scan the area effectively and efficiently to observe all snorkelers;
- Alert waders/snorkelers moving outside the designated site;
- Identify people in difficulty or distress;
- Act as a rescuer or first aider if required (see separate duty statements);
- Provide higher levels of supervision to participants assessed by the Activity Coordinator as being 'at risk' (to ensure they are removed from risk at the earliest possible opportunity).

Lead Diver

Must be physically fit for duties without risk to themselves or others; be an experienced snorkeler and assessor of marine hazards and snorkeler competence; and be qualified to instruct and rescue a snorkeler/wader and administer first aid.

Reports to the Activity Coordinator and works closely with Safety Observer.

Key Responsibilities:

1. Assist the Activity Coordinator to prepare the Dive Plan, including assessment of local risks and documenting any designated dive areas.
2. Ensure all safety procedures and equipment are in place (both onshore and in the water) and that all divers adhere to the buddy principle and remain within the designated dive area.
3. Maintain communication with a designated Deputy Diver and Safety Observer throughout the duration of people being in the water.
4. Ensure all divers understand and implement the project research method.

Specific duties:

- Work with the Activity Coordinator to identify and assess local marine hazards and ensure all risks are addressed within the Job Safety Analysis;
- Consult the Activity Coordinator on any expected boating activity and/or change of conditions prior to commencing in water activities;
- Ensure all dive equipment is maintained to appropriate operation standards;
- Confirm the designated dive area with the Safety Observer and deploy the Diver Below flag prior to divers entering the water;
- Undertake a snorkeler assessment and assist the Safety Observer in testing wetsuits of all divers are well-fitting prior to entering the water.
- **Work with the Deputy Diver as a buddy pair, maintaining visual contact at all times underwater**; and using relevant hand signals as required.
- Collect seastars from designated areas and transfer them to shore-based Data Collectors for data collection.
- Check in with the Safety Observer and Deputy Diver to report physical condition on each return to shore.

Data Collector(s)

Accurately records citizen science data required and responsible for sending completed data sheets to the Port Phillip Baykeeper (*baykeeper@ecocentre.com*). Minimal training and skills required (beyond familiarity with the data sheet, basic numeracy and legible hand-writing).

Public Relations Officer

During the event someone is needed to field public inquiries. This allows active participants to not get distracted from their role. The PR Officer will:

- Have a friendly and sunny disposition;
- Have a clear understanding of the purpose of the activity;
- Answer questions from curious passers-by;
- Hand out information brochures and tell people how to get involved.

Appendix 5

Community Rapid Response Teams data sheet

Location:		
Team Leader:		
Email:		**Phone:**
Start time:	**Finish time:**	**Date:**
Number of land-based volunteers & waders:		**Number of divers/snorkelers:**

Estimate of area cleaned (in m2):

Use landmarks to indicate approximate length of shoreline bordering the search area; plus estimate of how far people waded into the water. Optional - sketch map of clean up area with landmarks:

Area description. Tick all that apply:

- ☐ sand
- ☐ rocks/pebbles
- ☐ reef
- ☐ seagrass
- ☐ shells present
- ☐ pier/jetty
- ☐ rock goyne
- ☐ marina/harbor
- ☐ other: .....

Number of Northern Pacific seastars removed

Juveniles: (< 10 cm diameter)	Adults: (≥ 10 cm diameter)	Total number of NPS removed: (Juveniles + adults)
		Total Kg removed (optional):
		% of aggregation collected (estimate):
Number of live molluscs in catch bag:		Molluscs observed in NPS mouth:

The EcoCentre is a leading community-managed organisation with a dedicated team of scientists, educators and volunteers who design and implement innovative environmental programs. Our expertise is the health of Port Phillip Bay and the urban ecology of Greater Melbourne, within the traditional lands and waters of the Kulin Nation. We bring together people of all ages and backgrounds to spark solutions and inspire environmental leadership.

www.ecocentre.com

Email info@ecocentre.com to find out more about our team and our initiatives.

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