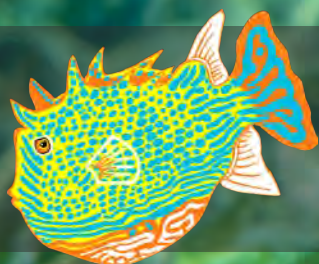


OUR MARINE LIFE ROCKS

# 2019 GREAT VICTORIAN FISH COUNT



ALINA BRUNE  
NICOLE MERTENS  
KADE MILLS



VICTORIAN  
NATIONAL PARKS  
ASSOCIATION  
*Be part of nature*

## Victorian National Parks Association

Our vision is to ensure Victoria is a place with a diverse and healthy natural environment that is protected, respected and enjoyed by all.

We work with all levels of government, the scientific community and the general community to achieve long term, best practice environmental outcomes and help shape the agenda for creating and managing national parks, conservation reserves and other important natural areas across land and sea in Victoria.

We are also Victoria's largest bushwalking club and provide a range of education, citizen science and activity programs that encourage Victorians to get active for nature.

## ReefWatch

ReefWatch is the Victorian National Parks Association's marine citizen science program. It provides projects that engage divers, snorkelers, rock pool rambblers and beach combers to contribute their observations, images and knowledge to expand our understanding of Victoria's unique marine life.

ReefWatch coordinates a number of marine citizen science programs, including the Melbourne Sea Slug Census, Dragon Quest and the Great Victorian Fish Count.

## Acknowledgements

Parks Victoria: Mark Rodrigue, Lachlan Cohen, Nickolas Bouma, Peter Hay, Jill Wheeler, Toby Larke, Shaun Davis, Thierry Rolland

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Atlas of Living Australia: Peter Brenton

Participating groups and schools: Asylum Seekers Resource Centre, Aquatic Adventures, Australian Dive Instruction, Bayplay, Daktari Surf/Bike/Dive, Dive and Dive, Dive2U, Eco Connect - Holistic Environmental Solutions, Friends of Beware Reef, Friends of Eagle Rock Marine Sanctuary, Friends of Harmers Haven, Friends of Mushroom Reef Marine Sanctuary, Friends of Point Addis, Friends of the Bluff, Jawbone Marine Sanctuary Care Group, Marine Care Ricketts Point, Mornington Peninsula Scuba Diving Club, Ocean Divers, Point Cooke Marine Sanctuary Care, Quarry Hill Primary School, Salesian College, Scuba Scouts Victoria, Scuba Culture, South Gippsland Conservation Society/Bunurong Coast Education, St Kilians Primary School, Sudanese Australia Integrated Learning, Victorian National Parks Association's Wild Families, WaterMaarq

Cover photo courtesy of Daniel Whitehorn. Chapter photo credits: Andreas Modinger, Andrew Christie, Kade Mills, Simon Meyer, Nicole Mertens



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## Project partners

### Parks Victoria

Parks Victoria's responsibilities under the Parks Victoria Act 1998 are to manage the state's parks, reserves, waterways and other public land, including a representative system of terrestrial and marine national parks and marine sanctuaries. It is also the local port manager for Port Phillip Bay, Western Port and Port Campbell.

Parks Victoria works in close partnership with other government and non-government organisations and community groups to manage parks and reserved and encourages community participation within them

Parks Victoria's philosophy of 'Healthy Parks Healthy People' promotes involvement in activities within parks to maintain and improve the health of individuals and the community as well as contributing to a better understanding of Victoria's parks. Participation in the Great Victorian Fish count is a great example of this and for connecting people and communities with parks.

### Coastcare Victoria

Coastcare Victoria is a state-wide program run by the Department of Environment, Land, Water and Planning (DELWP). Coastcare Victoria facilitators work directly with these communities and connect them with the state's coastal management system – coastal and natural resource management planners, managers of public land, local government and government programs targeting issues in coastal areas.

### Redmap

Redmap (Range Extension Database and Mapping project) is a national 'citizen science' site that captures data and maps marine species that may be extending their range in Australia in response to changes in the marine environment. In Victoria, Redmap is hosted by Museums Victoria and all recorded sightings are verified by marine scientists.

### Museums Victoria

Museums Victoria is Australia's largest public museum organisation. As the state museum for Victoria it is responsible for looking after a collection of nearly 12 million objects, documents, photographs and specimens. Its research, in the fields of science and humanities, uses the museum's collections and expert staff to further what we know about the social and natural history of Victoria and beyond.

**The Great Victorian Fish Count is supported by the Victorian Government.**







Keen participants about to explore Victoria's exciting underwater world | Nicole Mertens





## Executive summary

The Great Victorian Fish Count is Victoria's largest marine citizen science event, and each year it continues to connect communities to our coast. The theme for 2019 aimed to remind everyone that 'Our Marine Life Rocks', to encourage even more people to explore the Great Southern Reef and other spectacular natural marine habitats along Victoria's coastline. In total, 28 participating groups completed 50 surveys across the state's beautiful coastal waters, with over 700 citizen scientists taking part in the 'dive that counts'. The huge effort from everyone involved is a testament to the passion of the community when it comes to making meaningful contributions to our marine environment.

Key findings were:

- This year's face of the Fish Count, the ornate cowfish, was recorded in 20% of all surveys - similar to sightings in previous years. Nine participating groups were lucky enough to encounter this colourful fish during the Count.
- Western blue groper sightings doubled this year occurring in 12% of surveys.
- No sightings of southern blue devil were recorded, this is likely due to deep reefs not being surveyed this year.
- Once again the blue throat wrasse was the most commonly sighted species, recorded in over 80% of all surveys.
- For the first time, the second most observed species was the zebra fish, reported over 30% more often than usual. This may be due to the larger number of rocky reef sites surveyed this year or may be an

increase in abundance.

- Other frequently recorded species included:
  - Magpie perch
  - Six-spined leatherjacket
  - Dusky morwong
  - Sea sweep
- Marine parks and sanctuaries continue to be popular sites for the Fish Count. While only 5.3% of our coastal waters are protected, 34% of surveys were done in marine protected areas.

The results of the fifteenth Great Victorian Fish Count would not be possible without the 700+ enthusiastic divers and snorkelers who took part in this large-scale citizen science research project.

Data collected during the 2019 Fish Count is entered into the Atlas of Living Australia, making it accessible to scientists, managers and the community to learn more about Victoria's unique marine life. To date almost 5000 records have been accessed for research and education purposes.





# Our marine life rocks



A burst of living colour. This year we aim to remind everyone how exciting, unique and diverse our Victorian marine life is | Daniel Whitehorn (above) and Liz Harper (below)



## Introduction

### 1.1 Background

Combining the opportunity to collect real data on Victoria's marine life with a chance to dive in and experience our beautiful coast, the Great Victorian Fish Count is Victoria's largest marine citizen science event, and each year it reconnects participants with the ocean. We believe that it is a great starting point for people with no or little experience to explore Victoria's underwater world and develop a passion for protecting our unique marine life, as well as deepening knowledge and enthusiasm in more experienced volunteers. Now in its fifteenth year, the Fish Count is held through November and December with dive clubs, environmental groups, 'friends of' marine care groups, local dive operators, local community groups, schools, universities and the VNPA's Wild Families and beginner groups hitting the water to take part in collecting a 'snapshot' of fish diversity in our coastal waters.

Victoria's coastline has a diverse range of habitats that provide homes to a variety of species, many of which are not found anywhere else in the world. Almost a quarter of Australia's fishes are endemic with 60% of these species living only in our southern seas (Bray, 2018a). The fish count provides a 'snapshot' of some of these species and involves hundreds of divers recording thousands of fish sightings along the coastline. The data collected can be used to investigate changes in species composition and relative abundance at multiple locations throughout the state's coastal waters.

The Great Victorian Fish Count aims to help passionate people take part in an event that gathers valuable marine data, promotes active learning and

the chance to reconnect with their local coastal environment. In turn, this creates understanding, awareness and co-operation between the public, scientists and government agencies.

### 1.2 Citizen Science

Citizen science is the involvement of community members in scientific projects through the collection of data and/or involvement in project design. It provides an opportunity for participants to learn from each other. For example, the Great Victorian Fish Count brings together scientists, marine managers, divers, snorkelers and community members to increase and share our knowledge about fish found in their local waters.

In 2019 approximately 700 participants collected data on fish species across the Victorian coastline. Having so many pairs of eyes in the water searching for fish provides a large amount of data on the distribution and relative abundance of Victorian fish species. The data collected shows how citizen scientists can gather a vast amount of data, which would otherwise be extremely difficult to gather without the support of the community.



Pre-survey briefing of local community members at Hamers Haven | Nicole Mertens



### 1.3 Partnerships with local communities

Over the past 15 years, the Victorian National Parks Association in partnership with Museums Victoria, Parks Victoria, Coastcare Victoria, dive operators and local community groups, has led the Great Victorian Fish Count.

In 2015, we were pleased to add Redmap to our list of partners for the first time and continued to partner with them in 2019.

All project partners benefit the Great Victorian Fish Count by providing experience and knowledge on the Victorian marine environment. Project partners provide:

- Scientific expertise;
- Communication skills and knowledge;
- Local, regional and state-based knowledge on coasts, habitats and fish;
- Local community knowledge;
- Connection with local communities and networks;
- Skills, experience and qualifications to lead diving and snorkelling trips

This collaborative approach has made the Great Victorian Fish Count a success and we are grateful for the continued support of all our partners and look forward to continuing to work with them.

### 1.4 Welcoming very new Fish Counters

We were delighted to be able to involve new groups come and test the waters for their first Great Victorian Fish Count. This included the Asylum Seekers Resource Centre and Sudanese Australia Integrated Learning. As it was their first go at this activity the focus was on getting geared up, getting in the water and learning to snorkel. There

were definitely some huge smiles on the faces of those getting out of the water after their first ever try at snorkelling at these activities. We hope to welcome these groups back in the future to build on these new skills. Thanks to Jawbone Sanctuary Marine Care Group, Parks Victoria and Dive2U for hosting these groups.



A screenshot of a dusky morwong swimming by the underwater camera during a virtual count |The Nature Conservancy

### 1.5 Virtual Fish Count at Pope's Eye

In November 2019 ReefWatch went regional to bring a taste of the Fish Count to schools in Bendigo, central Victoria. Students from St Kilians and Quarry Hill primary schools took a virtual dive into the reef at Pope's Eye in Port Phillip Heads Marine Park, using The Nature Conservancy's ReefCam. Their survey results were verified by our Project Officer and uploaded to the Atlas of Living Australia's citizen science database along with the rest of the 2019 Fish Counts.

The students showed impressive fish ID skills and had thoughtful discussions around how valuable our Great Southern Reef and other temperate marine ecosystems are, both to our marine life and the people who rely on healthy coasts (everyone!). They also identified threats to our reefs and how they could make a positive difference, even from





Coming face to face with a male ornate cowfish at Flinders Pier | Liz Harper

200 kilometres away. The Virtual Fish Counts were a great way to introduce a wider audience to our coastal environment, and hopefully inspire a new generation of marine biologists, ambassadors and carers.

## 1.6 Our marine life rocks

The theme for the 2019 Fish Count was chosen to remind everyone that Victorian marine life “rocks”. From rocky reefs to sponge gardens, sea grass meadows to open water, Victoria’s marine life is rich and diverse. Our waters are also part of the spectacular ‘Great Southern Reef’, an interconnected temperate reef system that covers 71,000 km<sup>2</sup> and stretches over 5 states from North Western Australia to North New South Wales (Bennett et al., 2015). There are about 12,000 recognised marine plants and animals found in Victoria and about 80% of all species found at the ‘Great Southern Reef’ cannot be found anywhere else in the world (Bennett et al, 2015). Although the Fish Count only focusses on 35 fish species there are about 600 different fish that call our waters home (Department of Agriculture, Water and Environment , 2015).

We are lucky to have this unique environment right on our doorstep and we encourage everyone to get out there and explore Victoria’s marine life for yourself. There are activities suitable for everyone, like rock pool rambling, snorkelling, diving and many more to show you that our marine life truly rocks.

## 1.7 The 2019 fish ‘face’

Highlighting the abundance of vibrant marine habitats and marine life along Victoria’s coastline, the ‘face’ of the 2019 Great Victorian Fish Count was the colourful Ornate Cowfish (*Aracana ornate*).

The ornate cowfish inhabits bays, harbours, and sheltered coastal waters in southern Australia. It is usually found in seagrass beds and algae forests, up to a depth of 15 meters. It eats a variety of invertebrates that live close to the seafloor (Bray, 2017).

There are about 33 boxfish species worldwide with 20 occurring in Australia. In general, these species have distinct colouration, however, the ornate cowfish looks similar to shaw’s cowfish which is also found in Victoria. They can be differentiated by the horizontal



not diagonal lines on their face and the more erect spines above the eyes. (Hoese et al 2006; Kuitert 2000).

“This fish can ‘blow’ water into the sediment to expose their prey and make them an easy meal.”

This species is sexually dimorphic, meaning characteristics differ between males and females. The most obvious are their external appearances such as shape, colour or size (McCombe & Greer, 2013). Male ornate cowfish are colourful with a complex pattern of dots, lines, and net-like markings and a yellow tail with blue markings, the females on the other hand are dark brown with yellowish-white stripes and wavy lines. Males also have a distinct hump on the snout.

The body of an ornate cowfish is encased in a rigid box-like carapace comprised of large sculptured bony plates and bony ridges with large curved spines. Both male and female reach a maximum length of 15 centimetre (Bray, 2017).

Ornate cowfish are rarely kept in captivity as they have a toxic mucus that covers their body and will release a neurotoxin when stressed, often killing other fish in a tank (Thomson 1964). So your best chance of seeing them is in the wild.

## 1.8 The Atlas of Living Australia

Data collected during the Great Victorian Fish Count continues to be entered into the Atlas of Living Australia. The atlas is a collaborative, national project that brings together biodiversity data from multiple sources and makes it available and useable online. Data is entered via the BioCollect tool developed to support citizen scientists, ecologists, scientists and natural resource managers- [www.vnpa.org.au/reefwatch-biocollect](http://www.vnpa.org.au/reefwatch-biocollect). Currently there is limited information on the distribution of marine species

in Victoria, so the Great Victorian Fish Count is contributing important data in this space.

To date over 5000 Great Victorian Fish Count records have been accessed for research and education purposes.

## 1.9 Unusual sightings and identification

This year we received reports of species outside their usual range. However, unfortunately without an image we were unable to verify the sightings and report them to Redmap- [www.redmap.org.au](http://www.redmap.org.au).

We encourage participating groups to submit photos with their survey data, especially when reporting on uncommon species, as this assists us in confirming their presence and improves the quality of our data sets. **ReefWatch has cameras it can loan to groups** at all times, but, particularly during the Great Victorian Fish Count to help groups confirm their sightings and practice their underwater photography skills. Please contact us ([reefwatch@vnpa.org.au](mailto:reefwatch@vnpa.org.au)) at any time to organise a loan.





# CHAPTER 1

Some of the 2019 Fish Counters in action | South Gippsland Conservation Society (Rodney Webster, top left), Scuba Scouts (Bruce Ellis, top right), Bayplay & Wild Families (Nicole Mertens, middle & bottom)





The smiling (and sometimes fishy) faces of the 2019 GVFC | Ocean Divers (Liz Harper, top), Daktari (Sally Watson, middle left) Jawbone MSC (Nicole Mertens, middle right), Dive2U (Nicole Mertens, bottom)



## Methods

### 2.1 Survey Period

The 2019 Great Victorian Fish Count began on November 16 and finished on December 15.

The dates were chosen fifteen years ago to coincide with Coastcare Week, which is held on the first week of December. The fish count will continue to be held during the November/December period to allow for comparison of results with previous years.

### 2.2 Site selection

Surveys took place all along the Victorian Coastline (Figure 1) with participating groups choosing their own sites. To ensure continuity in data over time, groups have been encouraged to select a site they are familiar with and continue to monitor it each year.

Over half the sites (56%) surveyed were in Port Phillip Bay with many sights survey multiple times i.e. 40% of surveys in Port Phillip Bay were done at only four locations: Rye Pier, Pope's Eye, St Leonards Pier and Blairgowrie Marina. Rye Pier has been the most surveyed site since 2015. To examine the variability of fish sightings at a single dive site we have presented the last five years of data from Rye Pier (2015-2019).

Eastern and Western Victoria continue to have lower representation than the Bay region, but it is encouraging to see additional sites appearing in the survey data every year. The Victorian National Parks Association has continued to build stronger networks with local communities outside Port Phillip Bay to improve coverage in future Great Victorian Fish Counts. The following is a list of the sites surveyed during the 2019 Great Victorian Fish Count:

#### Western Victoria

- Addiscot Beach, Point Addis Marine National Park
- Eagle Rock Marine Sanctuary
- Port Campbell Bay
- Port Fairy - Pea Soup; South Beach Bay
- Portland - Lee Breakwater
- Warrnambool - Stingray Bay, Merri Marine Sanctuary

#### In and around Port Phillip Bay

- Barwon Bluff Marine Sanctuary
- Blairgowrie
- Daveys Bay Pier
- Flinders Pier
- Jawbone Marine Sanctuary
- Mornington Pier
- Mushroom Reef Marine Sanctuary
- Nepean Bay, Port Phillip Heads Marine National Park
- Point Cooke Marine Sanctuary
- Pope's Eye, Port Phillip Heads Marine National Park
- Portsea Pier
- Rye Pier
- Somers
- St Leonards Pier
- Tea House Reef, Ricketts Point Marine Sanctuary

#### Eastern Victoria

- Gippsland Lakes - Nyerimilang Jetty, Nyerimilang; Scone Point, Nungurner; The Stumps, Mosquito Point, Metung
- Wreck Bay, Hamers Haven
- Shack Bay, Bunurong Marine National Park.





Figure 1. Areas surveyed in 2019 | Photo insert: a snorkel instructor from Bayplay surveying their Portsea site

## 2.3 Survey Method

Each participating group leader is supplied with a standard Great Victorian Fish Count Kit. The kit contains training on how to conduct a count and where to upload the data, identification slates, and survey forms.

### The 'Roving Diver' Technique

All participants work in buddy pairs or small groups for the entire survey and share an identification slate. The Roving Diver Technique is employed, whereby the participants swim freely through the selected site and record all the fish identified on their monitoring slate.

Participants are encouraged to follow a route that does not overlap with other buddy pairs to cover a wider area, they are also advised to stop regularly to observe fish that may have been disturbed or had been hiding.

During the survey, participants place the observed fish species into one of three abundance categories on the identification slate. Each category has a corresponding symbol, which is crossed out progressively as increasing numbers of that particular species are observed (Figures 2, 3).

## 2.4 Data Summary

At the conclusion of each survey, the Great Victorian Fish Count data sheet (Figure 4) is completed in the company



of all the participating buddy pairs and groups. The survey form includes information regarding the survey site location, weather conditions, time spent completing the survey and visibility.

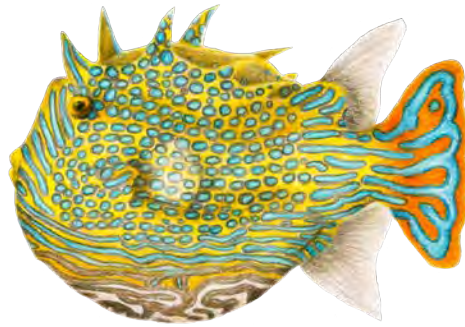


Figure 2. The abundance categories and corresponding symbols used on the Great Victorian Fish Count identification slates | Illustration by Nicole Mertens

The form is filled out immediately after the dive and involves consultation with all of the participants. The names of the 35 target species are listed on the form with additional space for any species the group would like to add. An abundance category is marked for each of the species observed by the group, based on the average abundance scores from all the participating buddy pairs.

Participating groups are encouraged to enter their results and photos directly to the Atlas of Living Australia (ALA) database [www.vnpa.org.au/reefwatch-biocollect](http://www.vnpa.org.au/reefwatch-biocollect) or email or post their results to the Victorian National Parks Association. Many people have commented on the ease and fast nature of submitting their results directly to the database and the Victorian National Parks Association will continue to encourage participants to upload their results this way.

## 2.5 Data presentation

Survey results emailed or posted to the Victorian National Parks Association are entered into the Atlas of Living Australia (ALA) database. Once all data is on ALA it is downloaded for analyses. Results from this year are presented to give an overview of main habitats surveyed, survey methods used and to illustrate the occurrence and abundance of species surveyed. Results are also compared to previous years.

Results are displayed as a percentage. This was calculated for each of the target species using the formula (percentage occurrence = number of surveys species sighted in / total number of surveys X 100). This enables a quick overview of which species were sighted more frequently during the Great Victorian Fish Count. All data is presented in the Appendices at the end of this report.

Each year some records are not uploaded to the Atlas of Living Australia despite groups successfully completing their surveys in the field. We encourage every participating group to make sure their data is counted and to get in touch with the Fish Count/ ReefWatch coordinator if any issues are encountered when submitting results.





Figure 3. Key to fish abundance categories | Photo insert: a “medium” sized school of sweep (Kade Mills)

**GVFC Survey Form**

**Registration Details**  
 Dive Group (registered dive operator/friends group):  
 Survey Method (SCUBA, Snorkel or SCUBA and Snorkel):

**Site Details**  
 Site name:  
 Location:  
 Latitude: Longitude:  
*If using a GPS, please use WGS 84 DATUM*

**Site Description**  
 Habitat (tick all that apply):  
 Large Rocky Reef (>2m face)  Low Rocky Reef (<2m face)  Rubble  
 Artificial Reef (eg. pier, wrecks)  Sand/Mud  Other  
 Type of cover (tick all that apply):  
 Kelp (long, leathery brown algae)  Mixed algae  Seagrass  
 Sponges, sea squirts & other  Other  
 If Other, please describe:

**Site Conditions**  
*The following are the site conditions on the day of the survey.*  
 Date of Survey: DD/MM/YYYY Time start: 24 hr time Time finish: 24 hr time  
 N° of divers: Duration: hours : mins Max. Depth: m Visibility: m Water Temp.: °C  
 Tide:  High  Low Swell height:  0m  0.5m  1m  1.5m  2m  
 Tidal stream:  Flood  Ebb  Slack Current:  Strong  Weak  Nil

Page 1

**GVFC Survey Form**

**Fish Count data**

Common name	1-5	6-20	20+
Dusky Morwong			
Red Morwong			
Banded Morwong			
Maggie Perch			
Bastard Trumpeter			
Herring Gale			
Horseshoe Leatherjacket			
Six-spined Leatherjacket			
Zebra Fish			
Southern Blue Devil			
Omate Cowfish			
Shaw's Cowfish			
Victorian Scalyfin			
Long snouted Boarfish			
Old Wife			
Sea Sweep			
Silver Sweep			
Western Blue Groper			
Eastern Blue Groper			
Blue Throat Wrasse			
Saddled Wrasse			
Senator Wrasse			
Maori Wrasse			
Harlequin Fish			
Weedy Sea Dragon			
Smooth Stingray			
Black Stingray			
Spotted Stingaree			
Southern Fiddler Ray			
Southern Eagle Ray			
Port Jackson Shark			
Spotted Wobbegong			
Elephant Fish			
Varied Carpetshark			
Draughtboard Shark			

Page 2

Figure 4. The data sheets to be completed at the end of a dive



## Results

### 3.1 General summary

#### 3.1.1 Participation and conditions

Fifty surveys were carried out by 28 groups at 28 different sites along Victoria’s coastline (Figure 1, also see Appendices 1-4 for data submitted on site locations).

The depth of sites varied from 4 -11m and visibility ranged from 1 - 20m. Water temperature was from 13 - 20°C (Appendix VI).

The number of fish counters in each participating group varied from two to 28 with participants spending 20 to 180 minutes conducting their survey (Appendix VI).

There were 4 virtual counts held for students at 2 regional schools. Between 22 to 66 students attended the virtual surveys per count, spending 10 to 15 minutes for each count.

#### 3.1.2 Survey methods

Snorkellers accounted for 42% of all surveys, with 40% undertaken by SCUBA divers and 10% of surveys were conducted with a mix of scuba divers and snorkelers with several groups hosting events that catered for both methods (Figure 5). This year 8% of the surveys were conducted virtually, using ReefCam the fixed underwater camera at Popes Eye Marine Sanctuary installed by The Nature Conservancy.

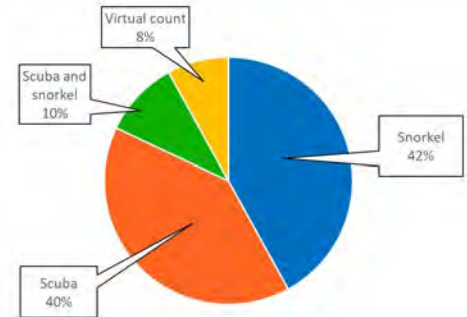


Figure 5. Survey methods used (%) (n= 50)

#### 3.1.3 Protection status of survey sites

The majority of surveys (66%) were conducted in unprotected waters with the remaining (34%) undertaken within marine national parks or sanctuaries (Figure 6).

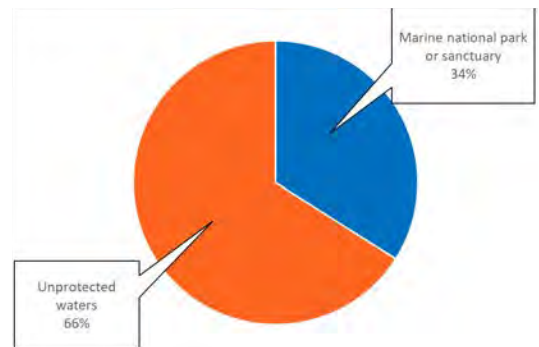


Figure 6. Protection status of survey sites (%) (n= 50)



### 3.1.4 Habitats surveyed

Most surveys were conducted on sites that had a combination of different habitats and/or vegetation. The majority of sites had some rocky reef and sand/mud. While artificial reefs and rubble was less common (Figure 7).

Mixed algae was the dominant vegetation, recorded at 80% of sites. This was followed by sponge gardens, kelp forests and seagrass meadows (Figure 8).

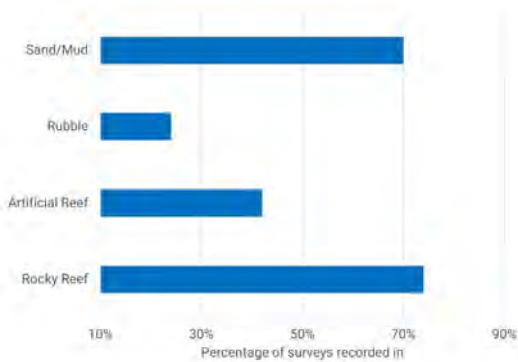


Figure 7. Habitat type surveys conducted on (%) (n=50)

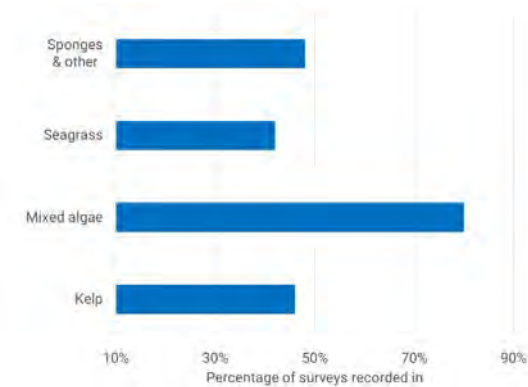


Figure 8. Vegetation type surveys conducted on (%) (n=50)



Different habitats and vegetation types can be home to different species. A stingray glides over a seagrass meadow at Jawbone Marine Sanctuary and a school of zebra fish dart between mixed algal species growing on a pier pylon at Portsea | Andrew Christie (above), Nicole Mertens (below)



## 3.2 The fish of 2019

### 3.2.1 Bony Fish

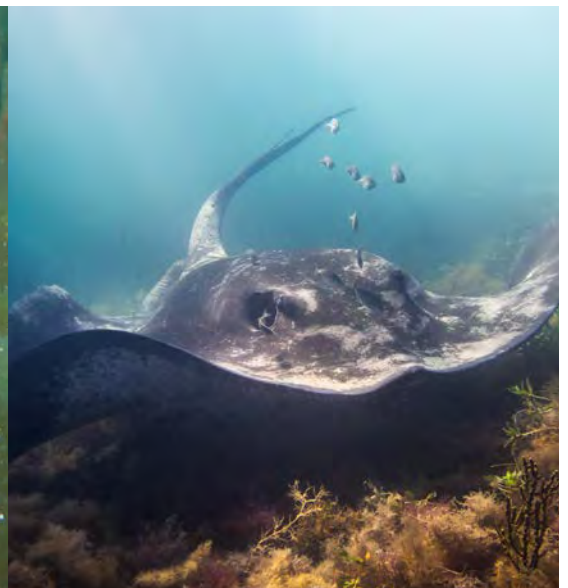
- The ‘face’ of the 2019 Fish Count, the ornate cowfish, appeared in 20% of surveys (Figure 9).
- Blue throat wrasse were the most commonly observed fish species, sighted in 84% of surveys and mostly recorded in abundances of 20 or more (Figure 9).
- Zebra fish and magpie perch were also frequently observed (76% and 72% respectively). Numbers of zebra fish were evenly distributed across all abundance categories, whereas magpie perch were mostly recorded in abundances of 1-5 individuals. (Figure 9).
- Other bony fish species observed in 50% or more of surveys were six-spined leatherjacket, dusky morwong, sea sweep and victorian scalyfin (Figure 9).
- Less common bony fish species included the bastard trumpeter, eastern blue groper, maori wrasse

and red morwong which appeared in less than 10% of the surveys conducted (Figure 9).

- The southern blue devil was not sighted in any surveys.

### 3.2.1 Sharks and Rays

- The two most commonly sighted of the shark and ray species were the smooth stingray (32%) and the southern fiddler ray, which was recorded in 30% of surveys (Figure 10).
- Less common shark and ray species include the draughtboard shark, and varied carpetshark, which were recorded in 2% of surveys (Figure 10).
- Most sharks or rays were recorded in abundances of one to 5 with none recorded in abundances of 20 or more (Figure 10).
- Spotted wobbegong and elephantfish were not sighted this year.



Our two stars of the 2019 Great Victorian Fish Count: blue throat wrasse (left) and smooth stingray (right) | Andreas Modinger (left) and PT Hirschfield (right)



## TARGET BONY FISH SPECIES

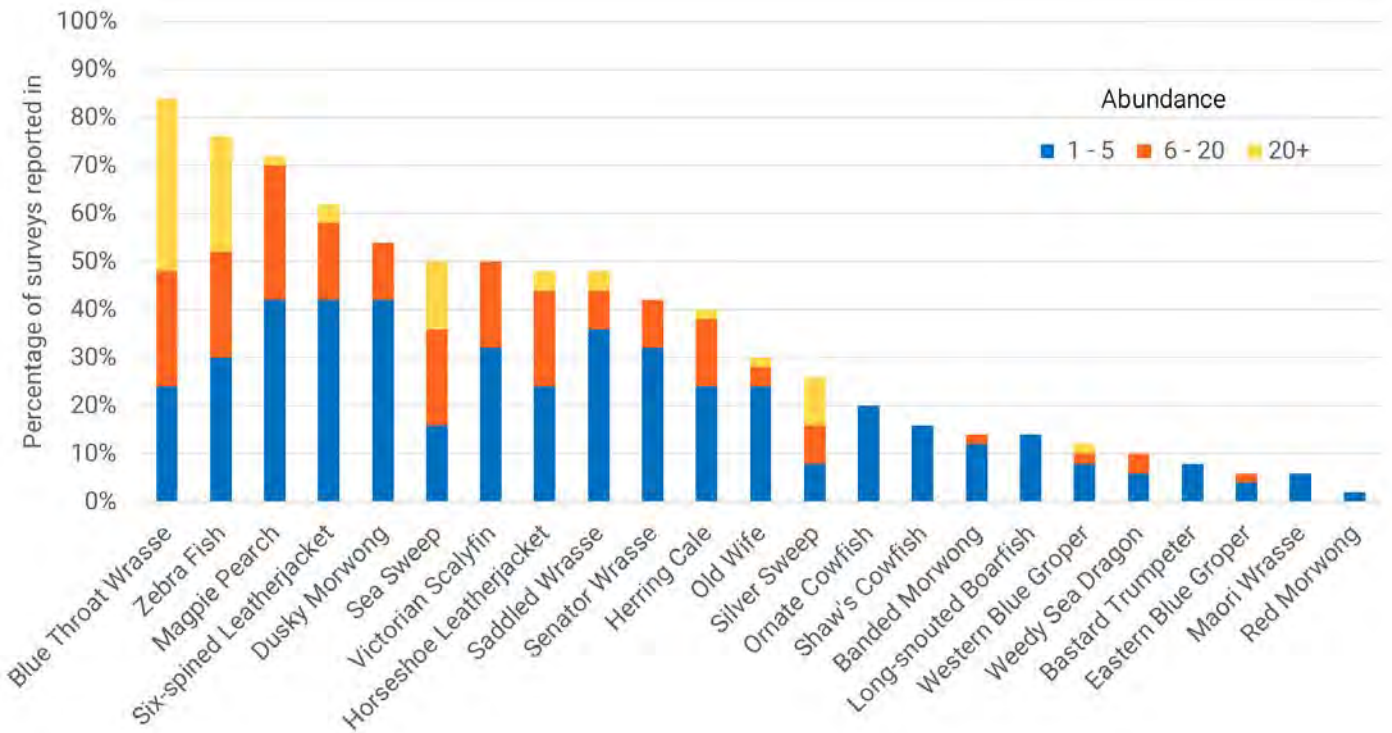


Figure 9. Percentage of surveys each bony fish species was recorded in and abundance category (n=50)

## TARGET SHARK AND RAY SPECIES

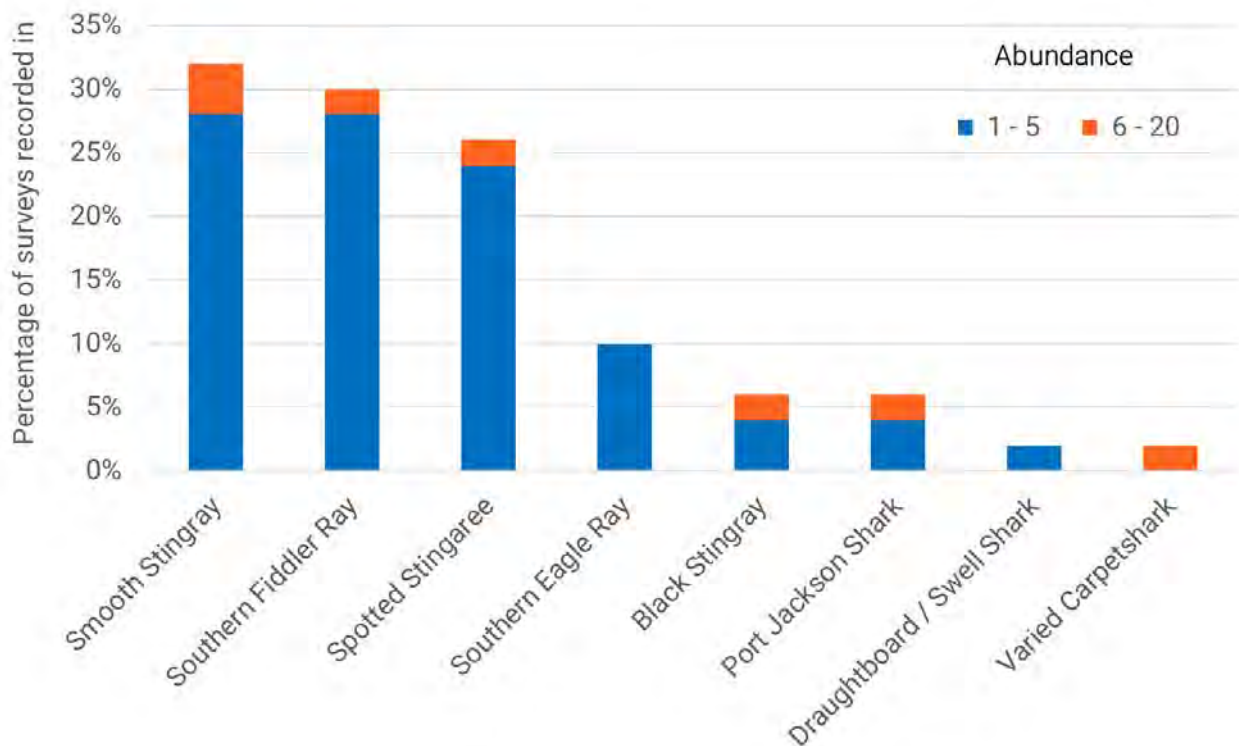


Figure 10. Percentage of surveys each shark and ray species was recorded in and abundance category (n=50)



# CHAPTER 3



Above: One of the most commonly sighted faces of 2019, the six-spined leatherjacket, and below: one of the less sighted faces of 2019, the old wife. Both species were encountered at Pope's Eye | Bruce Ellis







### 3.3 Comparison to previous years

The following comparisons are based on number of surveys where this species was recorded each year between 2015-2019.

#### 3.3.1 Bony Fish

- The blue throat wrasse has been the most commonly observed species since 2015 (Fig 11a).
- The second most observed species in 2019 was the zebra fish. Sightings increased by over 15% compared to the average between 2015-2018 (Fig 11a).
- Old wife sightings have declined since 2015. It was sighted half as frequently in 2019 compared to 2015-2018 (Figure 11a).
- Long-snouted boarfish sightings have been low for the past two fish counts (Figure 11a).
- Herring cale sightings bounced back to similar frequencies seen in 2015 after three years of low sightings (Figure 11b).
- Western blue groper sightings have increased to their highest occurrence in the past five years (Fig 11b).

#### 3.3.2 Sharks and Rays

- Smooth stingrays continue to be the most sighted shark and ray species, however sightings decreased by a third compared to 2018 (Figure 12).
- Spotted stingaree sightings have been steadily increasing since 2017 (Figure 12).
- Port Jackson shark sightings have been decreasing since 2017 (Figure 12).
- Southern eagle ray sightings have declined since 2017, this year sighting frequencies decreased by one third (Figure 12).

### Different methods yield different results- comparing Fish Count and Reef Life Survey data



Reef life Survey (RLS) is a non-profit citizen science program that trains SCUBA divers to undertake standardised scientific underwater visual surveys of reef biodiversity on rocky and coral reefs around the world. They use a 50m transect line and survey in two 5m wide by 5m high blocks parallel to the transect line to record all fish species. Two divers swim along those 'tunnels', about 1 meter over the ground recording all fish species in abundance and size. If encountering ledges or caves they survey beneath or in it. Their data is available for download online -[www.reeflifesurvey.com](http://www.reeflifesurvey.com).

From 2015-2019 RLS conducted a total of 40 surveys at 25 locations in Victoria in the months of November and December (2015: n=10, 2016: n=7, 2017: n=6, 2018: n=12, and 2019: n=5). Over the same time the Great Victorian Fish Count conducted 248 surveys (2015: n=42, 2016: n=44, 2017: n=55, 2018: n=57, and 2019: n=50) at 84 locations.

RLS recorded a total of 6 sharks and rays during the surveys: three southern fiddler rays, one smooth stingray, one spotted stingray and one draughtboard/swell shark. In 2019 no shark or ray species were recorded by RLS. The GVFC recorded sharks and rays in 168 occasions with up to 20 individuals per site from 2017-2019.

The results highlight the never-ending ecological challenge of getting a 'representative' sample of marine communities. The RLS method is designed to capture information on reef fish. RLS acknowledge that their methods are not primarily designed for monitoring jetties as they require 90% of the transects to be on hard substratum, allowing only small sand patches to be surveyed. However, unlike many of the reef fish targeted by the RLS method sharks and rays are highly mobile and often not found on reefs, but nearby on the reef edge on sand or seagrass and around artificial structures, like jetties, which are frequently dived during the GVFC.

The addition of sharks and rays to the Great Victorian Fish Count in 2017 is helping us learn more about some of Victoria's amazing cartilaginous fish.



## TARGET BONY FISH SPECIES

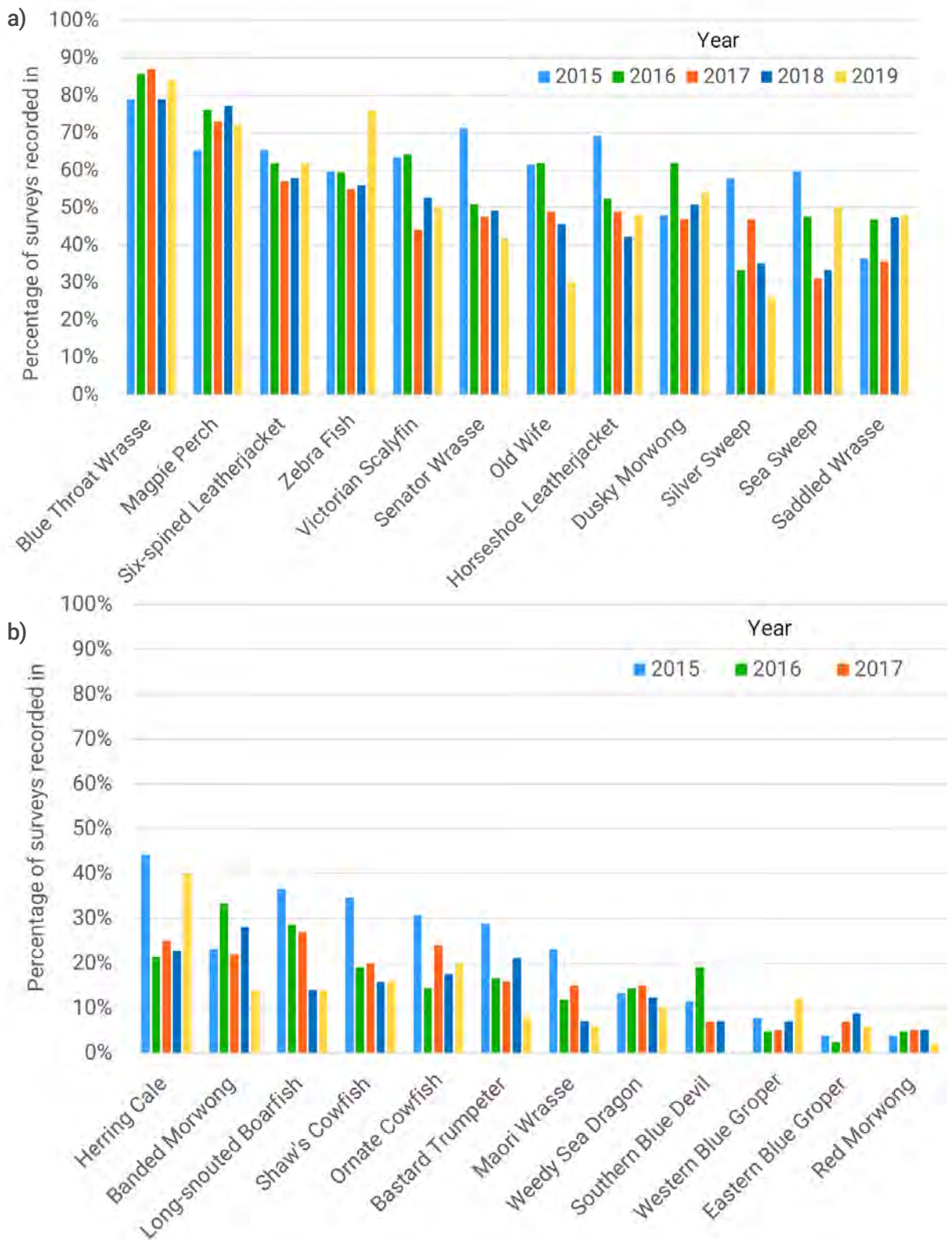


Figure 11. A comparison between the percentage occurrences of a) the most-sighted and b) the least-sighted target species\* of bony fishes calculated for the 2015 (n=42), 2016 (n=44), 2017 (n=55), 2018 (n=57) and 2019 (n=50) fish counts. Note: the harlequin fish was removed due to it not being recorded from 2015-2019

*Shark and ray target species comparisons for 2017, 2018 and 2019 are shown in Figure 12*



## TARGET SHARK AND RAY SPECIES

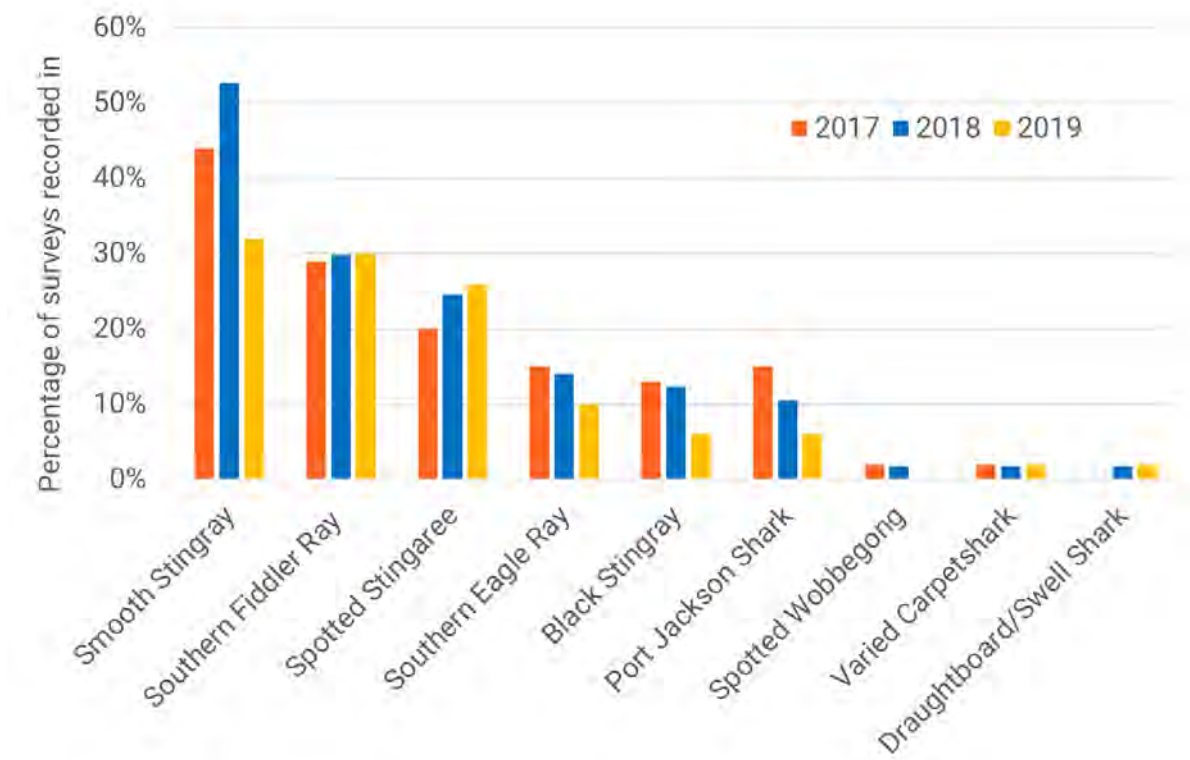


Figure 12. A comparison between the percentage occurrences of each target species\* of sharks and rays calculated for the 2017 (n=55), 2018 (n=57) and 2019 (n=50) fish counts. Note: the elephantfish was removed due to it not being recorded from 2017-2019



Requires good spotting skills: a lucky snapshot of a southern fiddler ray hiding in the seagrass at Point Cooke Marine Sanctuary | Andrew Christie



### 3.4 Comparison of Fish Counts at Rye Pier (2015-2019)

A total of 27 surveys have been conducted at Rye Pier over the past 5 years (Figure 13). Most participants were SCUBA divers, and group sizes varied from 2-17 participants (Figure 13, Appendix VII).

- Water temperatures ranged from 14-20°C (Appendix VII).
- Blue throat wrasse (96%), horseshoe leatherjacket and six-spined leatherjacket (both 82%) were the most commonly sighted species (Figure 14).
- The number of target fish sighted varied from 2-15 different species (Figure 14). While most species were recorded multiple times, the long snouted boarfish and spotted wobbegong\* were only sighted once.
- The three highlighted surveys in 2017 (signified by dark blue bars/dots in Figure 14) were all done in the middle of the day within a three-hour time window. Only three species were seen by all groups. A

further three species were observed by just two groups, and five species were only recorded in one out of three surveys (Figure 14).

- In contrast, the two surveys highlighted in 2019 were done at the same time by two different groups. One group sighted two additional species, but nine species were sighted by both groups (Figure 14).

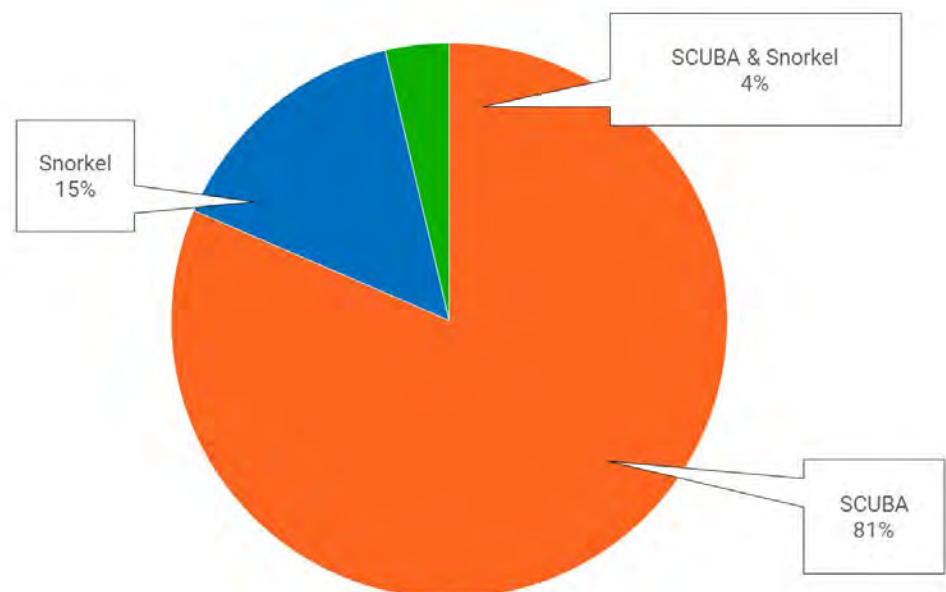


Figure 13. Survey methods used at Rye Pier 2015-2019 (%) (n= 27)





Figure 14. A virtual representation of all 27 surveys undertaken at Rye Pier 2015-2019 with target fish species sighted\*, visibility in meter, depths in meter and number of participants. \*Note: shark and ray species have been removed due to their exclusion from the survey prior to 2017. Highlighted (in dark blue) are 5 surveys to compare variation between surveys taken at similar times and conditions (see 3.4). The differences in fish sightings between the highlighted surveys in 2017 (n= 3) and 2019 (n= 2) are discussed on page 26.



## Discussion

### 4.1 General summary

#### 4.1.1 Participation and conditions

Victoria's unique and dynamic coastline is reflected in the range of site conditions encountered by participants.

As you might expect, groups undertaking counts on exposed rocky coasts were more likely to encounter unfavourable conditions than those in more sheltered locations, such as the many sites visited throughout Port Phillip Bay.

This year only one group had to reschedule the Fish Count, due to heavy rainfall in the preceding 24 hours. Previous years have had multiple Fish Counts rescheduled due to poor weather conditions.

#### 4.1.2 Survey technique

This year snorkelling and diving groups completed a similar number of surveys. Previous years have been dominated by SCUBA divers. The growth in snorkelling is a reflection of new groups of participants that are learning more about Victoria's marine life by taking part in the GVFC via more accessible methods for beginners - this includes families, students and culturally and linguistically diverse (CALD) groups.

SCUBA divers still represent a large group of participants thanks to the continued support and enthusiasm of local dive stores and clubs. The range of depths and areas able to be surveyed by SCUBA provides us with valuable data and greater representation of the diverse habitats found along our coastline.

This year we introduced the first virtual Fish Counts, thanks to the Nature

Conservancy's ReefCam installed at Popes Eye in Port Phillip Heads Marine National Park. It provided us with an opportunity to take the sea inland. Broadcasting a live stream of Victoria's underwater world opens up new opportunities for participants who cannot take part in snorkelling or diving activities. It is also great for identification purposes, because the whole count can be recorded. In case of an uncertain identification the saved video can be double checked or used as photo proof in case of an unusual sighting (e.g. for a submission to Redmap). We see the virtual surveys as a great addition to classic dive and snorkel Fish Counts.

Increasing participation in the Great Victorian Fish through snorkelling and virtual methods provides more opportunities for people to take their first step into exploring Victoria's amazing blue backyard.

#### 4.1.5 Protection Status

Established in 2002, Victoria's marine protected areas include marine national parks and marine sanctuaries. Marine protected areas cover approximately 63,000 hectares – 5.3% of Victoria's state marine waters (Parks Victoria, 2014). They provide people with the opportunity to experience and observe marine life undisturbed by fishing and other extractive activities. Despite only covering a small percentage of Victoria's marine waters, they are embraced and used widely by the diving community. This is evident from the large percentage of surveys carried out in marine protected areas in comparison to the size of coast they cover.





A male blue throat wrasse (*Notolabrus tetricus*), the most commonly sighted species in the Fish Count for the last 5 years  
| Bruce Ellis

## 4.2 The fish of 2019 and comparisons with previous years

### Blue Throat Wrasse

Blue throat wrasse are a dominant component of all shallow reef fish fauna from South Australia to New South Wales (Hutchins & Swainston, 1999).

They are sexually dimorphic, meaning there are differences in appearance between males and females. This is most obvious in their different shape, colour and size (McCombe & Greer, 2013). Juveniles and females are greenish to brownish, with females gradually developing a broad dark band on the side behind their pectoral fin. Males on the other hand are brownish to blue-grey with a distinct white band on the side, a pale bluish head with blue chin and yellow fins. (Bray, 2020a).

They are strongly site-associated (meaning they stay in the one place) and long-lived (up to 15 years). Adults usually inhabit rocky reefs and can be found in harems with ratios of one male to 10-20 females. Juveniles can be found in shallow weedy areas. Both of these habitats commonly occur at Fish Count sites, this likely explains their frequent sightings in this and previous Fish Counts.

Blue throat wrasse are born female and like many wrasse they can change from female to male during their life. This usually occurs when the dominant male leaves the harem. The most dominant female immediately changes sex to replace him. Intensive recreational fishing has been documented to reduce the number of large males in blue throat wrasse populations, as less fish reach the age or size requirement to change sex from female to male (Shepherd et al., 2010).

### Zebra Fish

Zebra fish are often seen around jetties, shallow rocky reefs and weedy areas (Gomon et al, 1994), habitats that were highly sampled in this year's surveys, which may account for their increased sightings compared to previous years.

The zebra fish has 8-10 black bars along its body and yellow fins, they have a diverse diet ranging from seaweed to invertebrates and are often sighted in small schools (Bray & Gomon, 2011).

### Magpie Perch

Growing to about 40 cm in length, the magpie perch is easily recognisable by its three broad black bands and reddish-brown tail. Actually a member of the morwong family, this fish is commonly found on coastal reefs throughout southern Australia. It is likely that



its presence on both sheltered and exposed coastal reefs accounts for its high rate of observation during the Great Victorian Fish Count. It is often seen sheltering in small groups under rocky structures (Bray 2019b).

Magpie perch and blue throat wrasse are considered to be indicators of fishing pressure, as they are both carnivorous fish and susceptible to fishing mortality. High numbers can indicate healthy reef fish assemblages (Shepherd et al, 2004), making it great to see both species in high numbers during recent Fish Counts.

### Herring Cale

Herring cale can grow up to 50 cm and have teeth in both jaws that are fused into a parrot-like beak that it uses to feed on brown macroalgae (Bray, 2020c). They inhabit inshore rocky areas, especially kelp forests. With nearly half of this year's fish counts taking place at sites with kelp, it was encouraging that they were frequently sighted.

### Blue Groper

Wilson's promontory is the divide between populations of eastern and western blue groper. As their name suggests eastern blue groper are found to the east of Wilson's Promontory and

western blue groper to the west.

With only three surveys conducted in Lakes Entrance, east of Wilson's Promontory, there were limited opportunities for the fish to be recorded. On the other hand, Western blue goppers were sighted more frequently and sightings have nearly doubled in recent years. This year they were sighted in six surveys at five locations (Barwon Bluff, Stingray Bay in Warrnambool, Blairgowrie, Mushroom Reef and Hamers Haven). Juvenile groper have also been sighted at Portsea during the 2019 Fish Count dates (Mertens 2019, personal communication). Increased sightings are likely in part due to increased awareness of their presence by the dive community, as well as these protected fish becoming resident at some locations. For example, Redmap has verified multiple sightings of western blue groper at Barwon Bluff, and assumes that this species is a resident of the area.

Similar to blue throat wrasse, blue groper live in a harem-like social structure, with one dominant male and a lot of females (Bray, 2018b). If the male is removed, the dominant female can change sex to become the dominant male. When queried it appears Fish Counters are only sighting female or juvenile blue goppers.



A southern blue devil (*Paraplesiops meleagris*) on a reef outside Port Phillip Heads | Karen Barwise



ReefWatch would love to hear about (and even better receive images of) large, male blue groppers.

### Southern Blue Devil

This dark blue fish with bright blue dots all over its body reaches a size of up to 35 cm. Blue devils have been recorded as living up to 60 years old and are strongly associated with a particular site. (Bray, 2020b). They prefer deep cave systems and ledges and are usually found in depths of 3m to over 40m (Gomon et al. 2008). This year the maximum depth of sites surveyed was 11 meters and large rocky reef habitats were not frequently encountered. In previous years sightings of blue devils have generally been recorded in large rocky reef habitats and in depths greater than 20 metres. It is likely that the lack of sighting this year was due to lack of suitable habitats surveyed rather than a lack of blue devils.

Furthermore, blue devils are known to hide in caves, crevices or under ledges, thus they can be easily missed. Anyone who captures blue devils on camera inside or outside the bay is encouraged to log their sighting using ReefWatch's Marine Life of Victoria iNaturalist page - [www.inaturalist.org/projects/marine-life-of-victoria](http://www.inaturalist.org/projects/marine-life-of-victoria). This project aims to collect observation data on a broad range of marine species sighted within Victorian waters at any stage, not just within the Fish Count dates.

### Old Wife

This fish has a deep, silver-white body with 6-8 brown-black bands, and tall dorsal fins with venomous spikes (Bray, 2020d). Its distinctive shape and colouration makes it an easy to spot fish. Old wives are known to live on coastal rocky reefs close to macroalgal and kelp beds where they primarily feed on crustaceans and worms (Bray, 2020d). Sightings of old wives have decreased since 2015. The decline in sightings may be due to the limited



The distinctive old wife (*Enoplosus armatus*)  
| Kade Mills

number of Fish Counts completed on the open coast, where you are more likely to find old wives. While they are seen inside Port Phillip Bay, they are patchy in their distribution and frequency of sightings. Again, anyone who captures old wives on camera inside or outside the bay is encouraged to log their sighting using the Marine Life of Victoria iNaturalist page.

### Long Snouted Boarfish

This fish is similar in appearance to an old wife but is often larger and has a distinct tubular snout (Bray, 2020e). It reaches a size of 50cm and can be found in depths of 3-260 meters. This boarfish inhabits rocky reefs and sandy areas, mostly found hiding under ledges or around caves (Hoese et al, 2006). Long-snouted boarfish sightings have decreased over the last couple of years during the Fish Count; and additionally none were recorded during forty Reef Life Surveys conducted over the same time period. Their infrequent sighting near heavily fished coasts has been noted by Edgar (2008) and may explain the decrease in sightings as many dive sites (i.e. piers) are popular with anglers.

### Smooth Stingray

Once again the smooth stingray was the most commonly sighted of the sharks and rays, recorded in approximately half of all surveys. Smooth stingrays are widespread in southern Australia (Bray 2018c). Their large size makes them



an easily recognisable species of ray, and their reported tendency to frequent piers throughout Victoria may account for their high rates of observation.

### Spotted Stingaree

This large stingaree grows up to 70 cm and is of dark brown to blackish colour with many pale irregular rings and spots (Bray, 2019a). It inhabits sandy areas around seagrass beds and shallow rocky reefs. Encouragingly, sightings for this species have remained stable since introducing shark and ray species to the Fish Count in 2017. The spotted stingaree often rests partly buried in sand and is thus well hidden.

### Spotted Wobbegong

The spotted wobbegong is a nocturnal predator, known to be sluggish during the day, when it often lies motionless (Last et al, 2009). Its colour and pattern make it easy for this species to blend in with its surroundings. Being nocturnal and well camouflaged during the day could explain why the spotted wobbegong has not been sighted this year.

A spotted wobbegong was reported in a survey this year. However, the photo of the specimen was sent in as well, and it was confirmed as a banded wobbegong (*Orectolobus halei*). These two species appear very similar and can only be distinguished by small differences in their colour patterns. The spotted wobbegong has broad dark saddles and distinctive o-shaped

spots, formed by groupings of white dots (Bray, 2018e), while the banded wobbegong has black edges around the saddles and fewer freckles.

This again highlights the importance of photos for ID purposes as identification of species encountered (often only briefly) underwater can be tricky, even for very experienced participants.

### Elephantfish

The elephantfish or Australian ghost shark has not been recorded during the Great Victorian Fish Count, and may never be- as they are very rarely encountered by divers. However, we would love to hear from you if you do encounter one any time you dive. Photo records would be even more exciting. While mature sharks are usually found in deeper offshore waters of up to 200m depths, females move into shallow waters to lay their eggs and juveniles remain inshore for up to three years, (Bray 2018d).

## 4.4 Variability of conditions and impacts on sightings

In last year's fish count report, we suggested that some fish species were not sighted in high numbers due to natural reefs being underrepresented. This year rocky reefs were the main reported habitat with over two third of all surveys conducted at locations with some rocky reef.

Nevertheless, Port Jackson shark sightings are still declining, and were sighted roughly half as frequently in 2019 compared to previous years. It was mentioned that this species often rests under rocky ledges (Bray, 2019b) and that could be the reason for less sightings. Other natural reef associated fish species were less sighted or only sighted again in low numbers compared to previous years. This might be due to fewer surveys being conducted on deeper reefs. Large rocky



A banded wobbegong (*Orectolobus halei*)  
| Tamryn Rice





Site conditions can have a significant impact on what species are out and about, as well as the likelihood of spotting them- these two photos were over the same patch of algae near Portsea pier on two different days | Nicole Mertens

reefs (>2m) were less represented than low rocky reefs (<2m), there were more people snorkelling and less diving than prior years and surveys were conducted at an average depth of 4 meters and a maximum of 11 meters. Some fish prefer deeper water, others hide under ledges, or live close to the bottom hiding in seagrass. These species might have been harder to sight this year, like the bastard trumpeter, long snouted boarfish, banded morwong and maori wrasse that have all been sighted less.

The detection of any species is dependent on more than just the species being present. The success of recording species and abundance has been found to be linked to the specific fish behavioural traits (Prais & Cabral, 2017). Individuals from the same population show different behavioural traits over time and across context (Bell et al., 2009). A widely accepted behavioural distinction is whether fish are shy or bold (Coleman et al., 1998). Bold fish were found to be more active, hide less and even to learn simple conditioning tasks quicker than shy fish (Sneddon, 2003). In regards to fish counts bold fish tend to be recounted and shy fish are likely to be missed in fish counts (Pais & Cabral, 2017).

Other external factors like time of day, weather, visibility, depths of survey, tide or just pure luck can be of great influence. Occasionally we hear from discouraged Fish Counters who did not find any target species or species they

expected to find during the Fish Count. The results from Rye Pier highlight site variability. Spotted target species varied in surveys conducted at the same day and even when conducted at the exact same time. We would like to encourage Fish Counters to stay motivated and curious even though you might not always encounter what you're expecting.

#### 4.6 Species not on slates

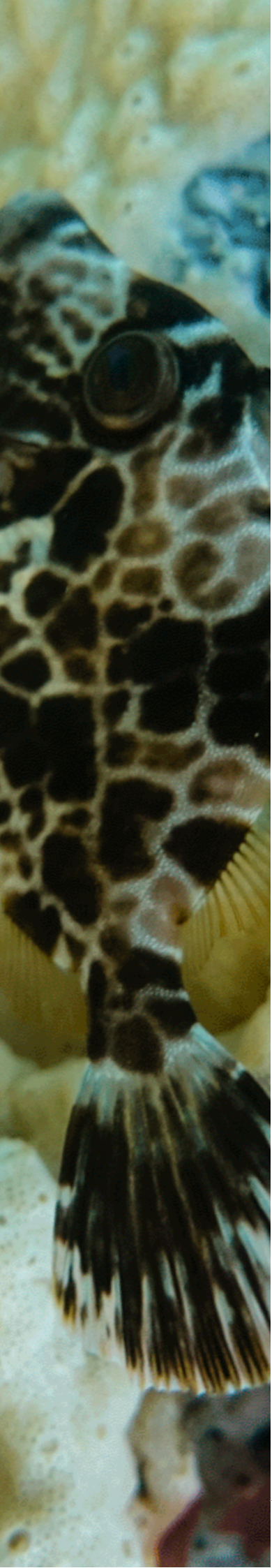
A number of species were recorded that do not appear on the official identification slates (see Appendix V). Common non-target species included globefish, moonlighters, smooth toadfish, yellowstriped leatherjacket, barber perch, and eastern shovelnose stingaree.

#### 4.7 Reports of 'fish on the move'

The Victorian National Parks Association has continued its partnership with Redmap Victoria. Once again participants were encouraged to keep an eye out for any fish that seem unusual in the area. Two unusual sightings have been reported.

Unfortunately, these remain unconfirmed as no photos were taken. We look forward to maintaining a watch for 'fish on the move' in Victoria and will contribute any recordings to Redmap – just don't forget to take a photo of your lucky find!





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A big thank you to all the dedicated ocean lovers who support the Great Victorian Fish Count each year, including these wonderful groups | Ting Ting Lee / ADI (top), Sally Watson / Daktari (middle left), Oskar Chen / Simple Dive (middle right), Bruce Ellis / SCUBA Scouts (bottom)



# Appendices

I: Summary of fish species sightings and abundances across Victoria

II: Table of fish species observed at each site surveyed in Western Victoria

III: Table of fish species observed at each site surveyed in and around Port Phillip Bay

IV: Table of fish species observed at each site surveyed in Eastern Victoria

V: Table of fish not on slates

VI: Table of the site conditions and habitat types recorded for each survey

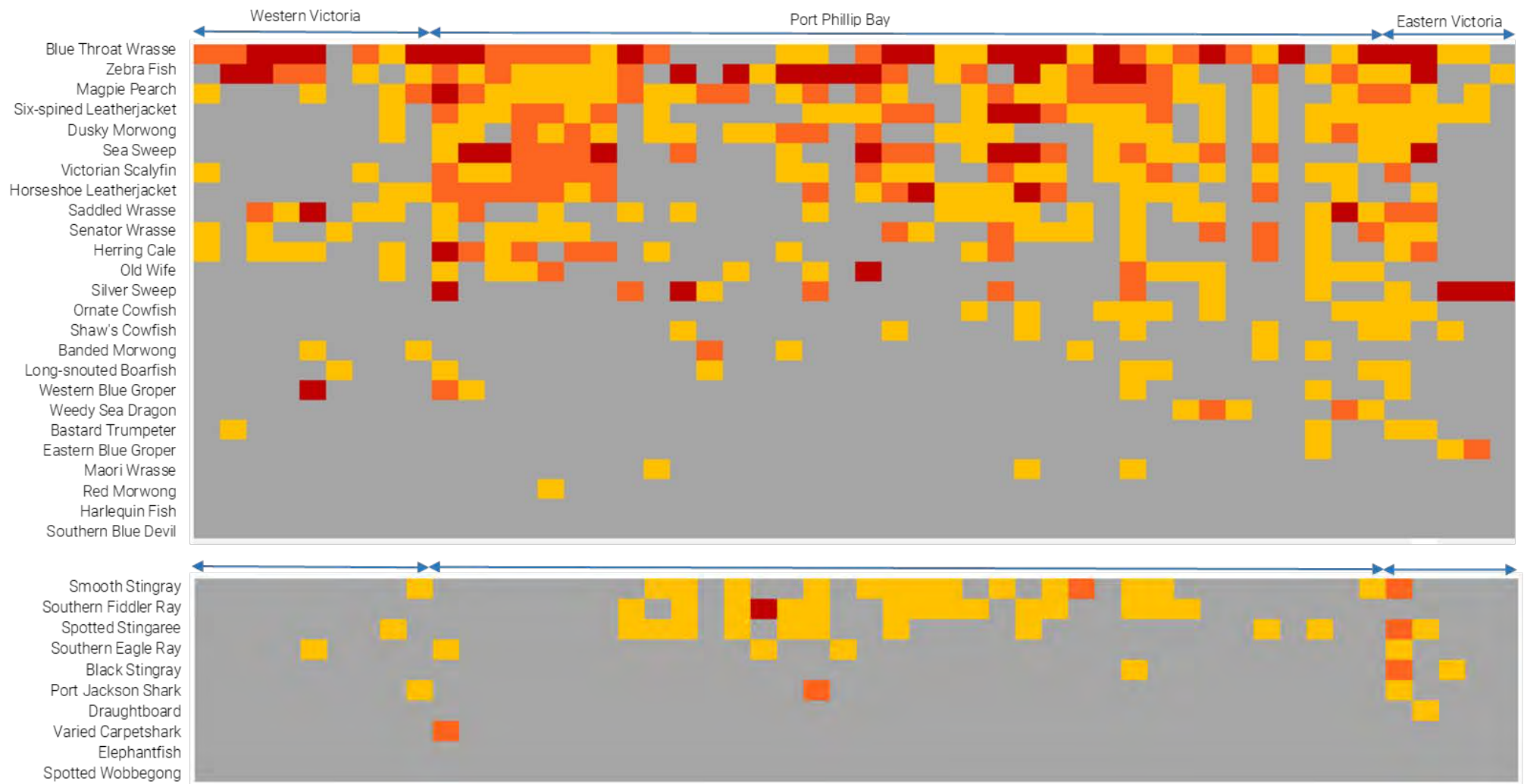
VII: Table of survey variables and species observed at Rye Pier 2015–2019



A buddy pair under Blairgowrie pier | Oskar Chen / Simple Dive



# Appendix I: Summary of fish species sightings and abundances across Victoria







<b>Red Morwong</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Harlequin Fish</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Southern Blue Devil</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Smooth stingray</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1 - 5	Nil	Nil
<b>Southern Fiddler Ray</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Spotted stingaree</b>	Nil	Nil	Nil	Nil	Nil	Nil	1 - 5	Nil	Nil	Nil
<b>Southern Eagle Ray</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1 - 5	Nil
<b>Black stingray</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Port Jackson Shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1 - 5	Nil	Nil
<b>Draughtboard / swell shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Spotted wobbegong</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Varied Carpetshark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Elephantfish / Australian ghost shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

### III: Table of fish species observed at each site surveyed in and around Port Phillip Bay

<b>Target Species</b>	<b>Barwon Bluff Marine Sanctuary (Parks Victoria &amp; Friends of the Bluff)</b>	<b>Barwon Bluff Marine Sanctuary (Parks Victoria &amp; Friends of the Bluff)2</b>	<b>Pope's Eye St Kilians 5/6 Virtual Count</b>	<b>Pope's Eye (Quarry Hill 5/6 Virtual Count)</b>	<b>Pope's Eye (Scout Scuba Vic)</b>	<b>Pope's Eye (Quarry Hill 3/4 Virtual Fish Count)</b>	<b>Pope's Eye (Quarry Hill 1/2 Virtual Count)</b>	<b>St Leonards Pier (Eco Connect - Holistic Environmental Solutions)</b>	<b>St Leonards Pier (Eco Connect - Holistic Environmental Solutions)</b>	<b>St Leonards Pier (Eco Connect - Holistic Environmental Solutions)</b>
<b>Blue Throat Wrasse</b>	20 +	20 +	6 - 20	6 - 20	6 - 20	6 - 20	1 - 5	20 +	6 - 20	Nil
<b>Zebra Fish</b>	6 - 20	1 - 5	6 - 20	1 - 5	1 - 5	1 - 5	1 - 5	6 - 20	Nil	20 +
<b>Magpie Pearch</b>	20 +	6 - 20	1 - 5	1 - 5	1 - 5	1 - 5	1 - 5	6 - 20	1 - 5	1 - 5
<b>Six-spined Leatherjacket</b>	6 - 20	1 - 5	1 - 5	6 - 20	6 - 20	1 - 5	6 - 20	Nil	1 - 5	Nil
<b>Dusky Morwong</b>	1 - 5	1 - 5	Nil	6 - 20	1 - 5	6 - 20	1 - 5	Nil	1 - 5	1 - 5
<b>Sea Sweep</b>	1 - 5	20 +	20 +	6 - 20	6 - 20	6 - 20	20 +	Nil	Nil	6 - 20





<b>Draughtboard / swell shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Spotted wobbegong</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Varied Carpetshark</b>	6 - 20	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Elephantfish / Australian ghost shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

### III (cont) Table of fish species observed at each site surveyed in and around Port Phillip Bay

Target Species	St Leonards Pier (Eco Connect - Holistic Environmental Solutions)	St Leonards Pier (Eco Connect - Holistic Environmental Solutions)2	St Leonards Pier (Australian Diving Instruction)	Point Cooke Marine Sanctuary (Point Cooke Marine Sanctuary Care & Parks Victoria)	Jawbone Marine Sanctuary (Jawbone Marine Sanctuary Care Group & Parks Victoria)	Tea House Reef (Marine Care Ricketts Point)	Daveys Bay Pier (Mornington Peninsula Scuba Diving Club)	Mornington Pier (Mornington peninsula Scuba Diving Club)	Rye Pier (Aquatic Adventures)	Rye Pier (Scuba Culture)
<b>Blue Throat Wrasse</b>	Nil	Nil	1 - 5	Nil	1 - 5	1 - 5	Nil	6 - 20	20 +	20 +
<b>Zebra Fish</b>	Nil	20 +	1 - 5	1 - 5	20 +	20 +	20 +	20 +	6 - 20	Nil
<b>Magpie Pearch</b>	6 - 20	6 - 20	1 - 5	Nil	1 - 5	6 - 20	Nil	6 - 20	1 - 5	Nil
<b>Six-spined Leatherjacket</b>	Nil	Nil	Nil	Nil	Nil	1 - 5	1 - 5	1 - 5	6 - 20	6 - 20
<b>Dusky Morwong</b>	Nil	1 - 5	Nil	1 - 5	6 - 20	6 - 20	Nil	6 - 20	Nil	Nil
<b>Sea Sweep</b>	Nil	Nil	Nil	Nil	1 - 5	Nil	Nil	20 +	6 - 20	6 - 20
<b>Victorian Scalyfin</b>	Nil	Nil	6 - 20	Nil	1 - 5	1 - 5	Nil	6 - 20	1 - 5	1 - 5
<b>Horseshoe Leatherjacket</b>	Nil	Nil	Nil	Nil	Nil	6 - 20	Nil	1 - 5	6 - 20	20 +
<b>Saddled Wrasse</b>	Nil	Nil	6 - 20	Nil	Nil	1 - 5	Nil	Nil	Nil	Nil
<b>Senator Wrasse</b>	Nil	Nil	1 - 5	Nil	Nil	Nil	Nil	Nil	6 - 20	1 - 5
<b>Herring Cale</b>	Nil	Nil	Nil	Nil	1 - 5	Nil	Nil	Nil	Nil	Nil
<b>Old Wife</b>	Nil	1 - 5	6 - 20	Nil	Nil	1 - 5	Nil	20 +	Nil	Nil
<b>Silver Sweep</b>	1 - 5	Nil	6 - 20	Nil	Nil	6 - 20	Nil	Nil	Nil	Nil
<b>Ornate Cowfish</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Shaw's Cowfish</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1 - 5	Nil







<b>Harlequin fish</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Southern Blue Devil</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Smooth stingray</b>	1 - 5	Nil	1 - 5	Nil	1 - 5	6 - 20	Nil	1 - 5	1 - 5	Nil
<b>Southern Fiddler Ray</b>	1 - 5	1 - 5	Nil	1 - 5	1 - 5	Nil	Nil	1 - 5	1 - 5	1 - 5
<b>Spotted stingaree</b>	Nil	Nil	Nil	1 - 5	Nil	Nil	Nil	Nil	Nil	Nil
<b>Southern Eagle Ray</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Black stingray</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1 - 5	Nil	Nil
<b>Port Jackson Shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Draughtboard / swell shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Spotted wobbegong</b>	Nil	Nil	1 - 5	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Varied Carpetshark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Elephantfish / Australian ghost shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

### 5.3 (cont) Table of fish species observed at each site surveyed in and around Port Phillip Bay

Target Species	Portsea Pier (VNPA & Bayplay)	Portsea Pier (VNPA & Bayplay)	Nepean Bay (Water Maarq)	Mushroom Reef Marine Sanctuary (Friends of Mushroom Reef Marine Sanctuary)	Mushroom Reef Marine Sanctuary (Friends of Mushroom Reef Marine Sanctuary)	Somers (Sue Letinger)	Flinders Pier (Ocean Divers)	Flinders Pier (Mornington Peninsula Scuba Diving Club)
<b>Blue Throat Wrasse</b>	20 +	6 - 20	1 - 5	20 +	Nil	1 - 5	1 - 5	20 +
<b>Zebra Fish</b>	Nil	Nil	6 - 20	Nil	1 - 5	Nil	6 - 20	1 - 5
<b>Magpie Pearch</b>	1 - 5	Nil	1 - 5	Nil	Nil	Nil	1 - 5	6 - 20
<b>Six-spined Leatherjacket</b>	1 - 5	Nil	1 - 5	Nil	1 - 5	Nil	1 - 5	1 - 5
<b>Dusky Morwong</b>	1 - 5	Nil	1 - 5	Nil	1 - 5	1 - 5	6 - 20	1 - 5
<b>Sea Sweep</b>	6 - 20	Nil	6 - 20	Nil	Nil	Nil	Nil	1 - 5
<b>Victorian Scalyfin</b>	1 - 5	Nil	1 - 5	Nil	1 - 5	Nil	1 - 5	Nil





<b>Spotted wobbegong</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Varied Carpetshark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
<b>Elephantfish / Australian ghost shark</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

#### IV: Table of fish species observed at each site surveyed in Eastern Victoria

Target Species	Harmers Haven (South Gippsland Conservation Society & Friends of Harmers Haven)	Shack Bay (South Gippsland Conservation Society & Bunurong Coast Education)	Gippsland Lakes (Friends of Beware Reef INC)	Gippsland Lakes (Friends of Beware Reef INC)	Gippsland Lakes (Friends of Beware Reef INC)
<b>Blue Throat Wrasse</b>	20 +	20 +	1 - 5	1 - 5	Nil
<b>Zebra Fish</b>	1 - 5	20 +	Nil	Nil	1 - 5
<b>Magpie Perch</b>	6 - 20	1 - 5	Nil	1 - 5	Nil
<b>Six-spined Leatherjacket</b>	1 - 5	1 - 5	1 - 5	1 - 5	Nil
<b>Dusky Morwong</b>	1 - 5	1 - 5	Nil	Nil	Nil
<b>Sea Sweep</b>	1 - 5	20 +	Nil	Nil	Nil
<b>Victorian Scalyfin</b>	6 - 20	Nil	Nil	Nil	Nil
<b>Horseshoe Leatherjacket</b>	Nil	1 - 5	Nil	Nil	Nil
<b>Saddled Wrasse</b>	6 - 20	6 - 20	Nil	Nil	Nil
<b>Senator Wrasse</b>	1 - 5	1 - 5	Nil	Nil	Nil
<b>Herring Cale</b>	1 - 5	6 - 20	Nil	Nil	Nil
<b>Old Wife</b>	Nil	Nil	Nil	Nil	Nil
<b>Silver Sweep</b>	1 - 5	Nil	20 +	20 +	20 +
<b>Ornate Cowfish</b>	1 - 5	1 - 5	Nil	Nil	Nil
<b>Shaw's Cowfish</b>	1 - 5	Nil	1 - 5	Nil	Nil
<b>Banded Morwong</b>	Nil	Nil	Nil	Nil	Nil
<b>Long-snouted Boarfish</b>	1 - 5	Nil	Nil	Nil	Nil
<b>Western Blue Groper</b>	1 - 5	Nil	Nil	Nil	Nil
<b>Weedy Sea Dragon</b>	Nil	Nil	Nil	Nil	Nil
<b>Bastard Trumpeter</b>	1 - 5	1 - 5	Nil	Nil	Nil
<b>Eastern Blue Groper</b>	Nil	Nil	1 - 5	6 - 20	Nil
<b>Maori Wrasse</b>	Nil	Nil	Nil	Nil	Nil
<b>Red Morwong</b>	Nil	Nil	Nil	Nil	Nil
<b>Harlequin fish</b>	Nil	Nil	Nil	Nil	Nil



<b>Southern Blue Devil</b>	Nil	Nil	Nil	Nil	Nil
<b>Smooth stingray</b>	6 - 20	Nil	Nil	Nil	Nil
<b>Southern Fiddler Ray</b>	Nil	Nil	Nil	Nil	Nil
<b>Spotted stingaree</b>	6 - 20	1 - 5	Nil	Nil	Nil
<b>Southern Eagle Ray</b>	1 - 5	Nil	Nil	Nil	Nil
<b>Black stingray</b>	6 - 20	Nil	1 - 5	Nil	Nil
<b>Port Jackson Shark</b>	1 - 5	Nil	Nil	Nil	Nil
<b>Draughtboard / swell shark</b>	Nil	1 - 5	Nil	Nil	Nil
<b>Spotted wobbegong</b>	Nil	Nil	Nil	Nil	Nil
<b>Varied Carpetshark</b>	Nil	Nil	Nil	Nil	Nil
<b>Elephantfish / Australian ghost shark</b>	Nil	Nil	Nil	Nil	Nil



Fish Counters have the chance to record non-target species they encounter (such as Yellowstripe Leatherjackets) which can also be added to ALA. See Appendix V for a full list of non-target species sighted during the 2019 Fish Count | Karen Barwise

## V: Table of fish not on slates

Survey Site	Additional Species Recorded
<b>Western Victoria</b>	
Addiscot Beach	Australian Herring ( <i>Arripis georgianus</i> ), Black Bream ( <i>Acanthopagrus butcheri</i> ), Eastern Kelpfish ( <i>Chironemus marmoratus</i> ), Moonlighter ( <i>Tilodon sexfasciatus</i> ), Sparsely-spotted Stingaree ( <i>Urolophus paucimaculatus</i> )
Eagle Rock Marine Sanctuary	Smooth Toadfish ( <i>Tetractenos glaber</i> )
Port Campbell Bay	Eastern Australian Salmon ( <i>Arripis trutta</i> )
<b>Port Phillip Bay</b>	
Barwon Bluff Marine Sanctuary	Common Toadfish, Eastern Australian Salmon ( <i>Arripis trutta</i> ), Luderick ( <i>Girella tricuspidata</i> ), Marblefish ( <i>Aplodactylus arctidens</i> ), Moonlighter ( <i>Tilodon sexfasciatus</i> ), Sergeant Baker ( <i>Latropiscus purpurissatus</i> ), Smooth Toadfish ( <i>Tetractenos glaber</i> ), Yelloweye Mullet ( <i>Aldrichetta forsteri</i> ), Yellow-stripe Leatherjacket ( <i>Meuschenia flavolineata</i> )
Blairgowrie	Bigscale Bullseye ( <i>Pempheris multiradiata</i> ), Bluespotted Goatfish ( <i>Upeneichthys vlamingii</i> ), Eastern Shovelnose Stingaree ( <i>Trygonoptera imitata</i> ), Globefish ( <i>Diodon nicthemerus</i> ), Moonlighter ( <i>Tilodon sexfasciatus</i> ), Port Phillip Pipefish ( <i>Vanacampus phillipi</i> ), Southern Cardinalfish ( <i>Vincentia conspersa</i> ), Sparsely-spotted Stingaree ( <i>Urolophus paucimaculatus</i> ), Toothbrush Leatherjacket ( <i>Acanthaluteres vittiger</i> )
Daveys Bay Pier	Globefish ( <i>Diodon nicthemerus</i> ), Smooth Toadfish ( <i>Tetractenos glaber</i> )
Flinders Pier	Globefish ( <i>Diodon nicthemerus</i> ), Gunn's Leatherjacket ( <i>Eubalichthys gunnii</i> ), Tasmanian Blenny ( <i>Parablennius tasmanianus</i> )
Jawbone Marine Sanctuary	Blue Weed Whiting ( <i>Haletta semifasciata</i> ), Bluespotted Flathead ( <i>Platycephalus caeruleopunctatus</i> ), Eastern Shovelnose Stingaree ( <i>Trygonoptera imitata</i> ), Globefish ( <i>Diodon nicthemerus</i> ), Longsnout Flounder ( <i>Ammotretis rostratus</i> ), Port Phillip Pipefish ( <i>Vanacampus phillipi</i> ), Rough Leatherjacket ( <i>Scobinichthys granulatus</i> ), Smooth Toadfish ( <i>Tetractenos glaber</i> ), Snapper ( <i>Pagrus auratus</i> )
Mornington Pier	Globefish ( <i>Diodon nicthemerus</i> ), Moonlighter ( <i>Tilodon sexfasciatus</i> ), Red Gurnard ( <i>Chelidonichthys kumu</i> ), Shorthead Seahorse ( <i>Hippocampus breviceps</i> )
Mushroom Reef Marine Sanctuary	Bass Strait Flounder ( <i>Arnoglossus bassensis</i> ), Blue Weed Whiting ( <i>Haletta semifasciata</i> ), Eastern Australian Salmon ( <i>Arripis trutta</i> ), King George Whiting ( <i>Sillaginodes punctatus</i> ), Little Weed Whiting ( <i>Neodax balteatus</i> ), Rough Leatherjacket ( <i>Scobinichthys granulatus</i> ), Smooth Toadfish ( <i>Tetractenos glaber</i> ), Snapper ( <i>Pagrus auratus</i> ), Southern Sand Flathead ( <i>Platycephalus bassensis</i> ), Tasmanian Blenny ( <i>Parablennius tasmanianus</i> )
Nepean Bay	Blue Weed Whiting ( <i>Haletta semifasciata</i> ), Marblefish ( <i>Aplodactylus arctidens</i> ), Moonlighter ( <i>Tilodon sexfasciatus</i> ), Southern Cardinalfish ( <i>Vincentia conspersa</i> )
Point Cooke Marine Sanctuary	Eastern Shovelnose Stingaree ( <i>Trygonoptera imitata</i> ), Globefish ( <i>Diodon nicthemerus</i> )
Pope's Eye	Barber Perch ( <i>Caesioperca rasor</i> ), Marblefish ( <i>Aplodactylus arctidens</i> ), Moonlighter ( <i>Tilodon sexfasciatus</i> ), Yellowstriped Leatherjacket ( <i>Meuschenia flavolineata</i> )
Portsea Pier	Eastern Shovelnose Stingaree ( <i>Trygonoptera imitata</i> ), Globefish ( <i>Diodon nicthemerus</i> ), Tasmanian Blenny ( <i>Parablennius tasmanianus</i> )
Rye Pier	Globefish ( <i>Diodon nicthemerus</i> ), Potbelly Seahorse ( <i>Hippocampus bleekeri</i> ), Yelloweye Mullet ( <i>Aldrichetta forsteri</i> )
St Leonards	Flathead Gudgeon ( <i>Philypnodon grandiceps</i> ), Pipefish, Toadfish
Tea House Reef	Moonlighter ( <i>Tilodon sexfasciatus</i> )



## VI: Table of the site conditions and habitat types recorded for each survey

Survey Site	Group	Date & Time	Survey method	No. of Participants	Max. Depth (m)	Visibility (m)	Water Temp. (°C)	Tide Level	Tidal Stream	Swell Height (m)	Current	Habitat Type
<b>Western Victoria</b>												
Addiscot Beach	Friends of Point Addis	15/11/2019 11:20am - 12:20pm	Snorkel	1	4	4	0	Low	Ebb	1 m	-	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Mixed Algae, Seagrass
Port Campbell Bay	Daktari Surf/Bike/Dive	20/11/2019 10:00am - 10:40am	Snorkel	2	3	4	15	Low	Flood	0.5 m	Weak	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Seagrass, Sponges, Seasquirts & Other
Eagle Rock Marine Sanctuary	Friends of Eagle Rock Marine Sanctuary	20/11/2019 11:00am - 12:30pm	Snorkel	8	2	4	16	Low	Slack	0.5 m	Weak	Low Rocky Reef (<2m), Kelp, Mixed Algae
Pea Soup, Point Fairy	Daktari Surf/Bike/Dive	30/11/2019 09:30am - 10:00am	Snorkel	2	1	15	17	Low	Slack	0.5 m	Nil	Low Rocky Reef (<2m), Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
South Beach Bay, Port Fairy	Daktari Surf/Bike/Dive	30/11/2019 9:39am - 10:18am	SCUBA	4	4	15	16	Low	Slack	0.5 m	Nil	Low Rocky Reef (<2m), Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Lee Breakwater, Portland	Daktari Surf/Bike/Dive	07/12/2019 -	SCUBA	2	7	2	16	Low	Flood	0.5 m	Weak	Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Seagrass, Sponges, Seasquirts & Other
South Beach Bay, Port Fairy	Daktari Surf/Bike/Dive	08/12/2019 10:30am - 11:20am	SCUBA	5	5	15	16	Low	Ebb	0.5 m	Weak	Low Rocky Reef (<2m), Rubble, Sand/Mud, Kelp, Mixed Algae, Seagrass
Port Campbell Bay	Daktari Surf/Bike/Dive	9/12/2019 10:30am - 11:15am	SCUBA	2	8	5	15	High	Ebb	0.5 m	Nil	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
Stingray Bay, Warrnambool	Daktari Surf/Bike/Dive	10/12/2019 12:45pm - 01:30pm	Snorkel	3	1	10	16	Low	Slack	0.5 m	Nil	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Rubble, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
<b>Port Phillip Bay</b>												
Rye Pier	Scuba Culture	16/11/2019 10:20am - 11:24am	SCUBA	5	5	10	14	Low	Flood	0 m	Nil	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Blaigowrie	Aquatic Adventures	20/11/2019 08:36am - 09:29am	SCUBA	7	4.5	5	13	Mid	Ebb	0 m	Strong	Artificial Reef, Mixed Algae, Sponges, Seasquirts & Other

Blairgowrie	Dive2U	23/11/2019 02:00pm - 04:00pm	SCUBA and Snorkel	28	5	10	18	Low	Flood	0 m	Weak	Artificial Reef, Kelp, Mixed Algae, Sponges, Seasquirts & Other
Tea House Reef	Marine Care Ricketts Point	11/23/2019 09:30am - 10:30am	SCUBA and Snorkel	20	10	9	14.5	Low	Slack	0 m	Nil	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
Rye Pier	Scuba Culture	23/11/2019 10:19am - 11:25am	SCUBA	5	5	6	16	Mid	Flood	0 m	Nil	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Rye Pier	Dive2U & Wild Families	24/11/2019 01:10pm - 02:10pm	Snorkel	16	4	5	17	High	Ebb	0 m	Nil	Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
Rye Pier	Dive2U & Wild Families	24/11/2019 11:00am - 12:00pm	Snorkel	9	4	5	17	High	Slack	0 m	Nil	Artificial Reef, Sand/Mud, Kelp, Mixed Algae
Pope's Eye	Quarry Hill	26/11/2019 03:00pm - 03:10pm	Virtual Fish Count	24	2	5	16	Low	Ebb	2 m	Weak	Large Rocky Reef (>2m), Artificial Reef, Rubble
Pope's Eye	Quarry Hill	27/11/2019 04:56pm - 05:07pm	Virtual Fish Count	20	2	5	16	Low	Slack	1 m	Weak	Large Rocky Reef (>2m), Artificial Reef, Rubble, Kelp, Mixed Algae
Pope's Eye	Quarry Hill	28/11/2019 10:40am - 10:55am	Virtual Fish Count	24	2	3	16	Low	Flood	1 m	Weak	Large Rocky Reef (>2m), Artificial Reef, Rubble, Mixed Algae
Pope's Eye	St Kilians	29/11/2019 07:00am - 07:15am	Virtual Fish Count	66	2	3	16	Mid	Slack	1 m	Weak	Large Rocky Reef (>2m), Low Rocky Reef (>2m), Rubble, Kelp, Mixed Algae
Rye Pier	Aquatic Adventures	30/11/2019 10:16am - 11:10am	SCUBA	15	5	15	14	Low	Flood	0 m	Nil	Artificial Reef, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Mushroom Reef Marine Sanctuary	Friends of Mushroom Reef Marine Sanctuary	30/11/2019 9:00am - 11:30am	Snorkel	10	4	10	16	Low	Flood	0.5 m	Weak	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
Mushroom Reef Marine Sanctuary	Friends of Mushroom Reef Marine Sanctuary	30/11/2019 9:30am - 11:30am	Snorkel	10	4	10	16	Low	Flood	0.5 m	Weak	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
Flinders Pier	Mornington Peninsula Scuba Diving Club	30/11/2019 10:00am - 11:00am	SCUBA	5	5	12	15	Low	Slack	0 m	Nil	Artificial Reef, Mixed Algae, Sponges, Seasquirts & Other
Flinders Pier	Ocean Divers	30/11/2019 9:30am - 11:00am	SCUBA and Snorkel	24	4.5	10	16	High	Ebb	0 m	Nil	Sand/Mud, Kelp, Seagrass
Rye Pier	Scuba Culture	30/11/2019 10:19am - 11:17am	SCUBA	12	5	8	16	Mid	Flood	0 m	Nil	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other



Somers	Sue Letinger	30/11/2019 10:05am - 10:40am	Snorkel	1	1	2	16.5	Low	Ebb	0.5 m	Weak	Low Rocky Reef (<2m), Sand/Mud, Mixed Algae, Seagrass, Sponges, Seasquids & Other
Barwon Bluff Marine Sanctuary	Friends of the Bluff & Parks Victoria	01/12/2019 9:50am - 10:25am	Snorkel	19	1	4	16	Low	-	1 m	Weak	Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other
St Leonards Pier	Eco Connect - Holistic Environmental Solutions	7/12/2019 01:45pm - 02:35pm	SCUBA	3	3.6	3	0	-	-	-	-	-
St Leonards Pier	Eco Connect - Holistic Environmental Solutions	7/12/2019 01:58pm - 02:52pm	SCUBA	2	3.6	4	0	-	-	-	-	Low rocky reef (<2m), Artificial Reef
St Leonards Pier	Eco Connect - Holistic Environmental Solutions	7/12/2019 02:00pm - 03:02pm	SCUBA	4	3	3	0	-	-	-	-	-
St Leonards Pier	Eco Connect - Holistic Environmental Solutions	7/12/2019 02:11pm - 03:09pm	SCUBA	3	3.5	4	0	-	-	-	-	-
Pope's Eye	Scuba Scouts Vic	7/12/2019 12:21pm - 12:42pm	SCUBA	4	11	8	16	High	Flood	-	Weak	Large Rocky Reef (>2m), Kelp, Mixed Algae, Sponges, Seasquirts & Other
Portsea Pier	VNPA & Bayplay	7/12/2019 01:50pm - 03:00pm	Snorkel	15	5	10	17	Low	Ebb	0.5 m	Weak	Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Seagrass, Sponges, Seasquids & Other
Portsea Pier	VNPA & Bayplay	7/12/2019 10:00am - 11:00am	Snorkel	6	5	10	17	High	Slack	0.5 m	Weak	Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Seagrass, Sponges, Seasquids & Other
Blairgowrie	Andreas and Ben Blairgowrie	7/12/2019 09:00am - 10:20am	SCUBA	2	5	8	15	High	Slack	0 m	Nil	Artificial Reef, Mixed Algae, Seagrass
St Leonards Pier	Eco Connect - Holistic Environmental Solutions	8/12/2019 -	Snorkel	10	1	4	0	-	-	-	-	-
Mornington Pier	Mornington peninsula Scuba Diving Club	8/12/2019 02:00pm - 02:45pm	SCUBA	3	10	5	15	High	Ebb	0 m	Nil	Artificial Reef, Sand/Mud, Mixed Algae
Daveys Bay Pier	Mornington Peninsula Scuba Diving Club	09/12/2019 10:20am - 11:20pm	SCUBA and Snorkel	4	3	5	15	Low	Slack	0 m	Nil	Sand/Mud, Mixed Algae
Blairgowrie	Mornington Peninsula Scuba Diving Club	11/12/2019 11:30am - 01:00pm	SCUBA	4	5	10	15	High	Flood	0 m	Nil	Artificial Reef, Sand/Mud, Mixed Algae

Jawbone Marine Sanctuary	Jawbone Marine Sanctuary Care Group & Parks Victoria	14/12/2019 09:48am - 10:35am	Snorkel	15	4	5	17	Low	Ebb	0 m	Nil	Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Seagrass
Nepean Bay	Water Maarq	14/12/2019 09:00am - 09:45am	Snorkel	10	5	10	19	Low	Ebb	0 m	Nil	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Kelp, Mixed Algae, Seagrass
St Leonards Pier	Australian Diving Instruction	14/12/2019 08:00am - 10:00am	SCUBA	20	5	5	17	Low	Flood	1.5 m	-	Artificial Reef, Rubble, Sand/Mud, Seagrass
Rye Pier	Dive and Dive	15/12/2019 02:10pm - 03:10pm	SCUBA	6	4.6	8	16	High	Flood	0.5 m	Strong	Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Portsea Pier	Salesian College	22/12/2019 11:00am - 12:30pm	Snorkel	20	5	20	16	-	-	-	-	Low Rocky Reef (<2m), Artificial Reef, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Barwon Bluff Marine Sanctuary	Parks Victoria & Friends of the Bluff	24/12/2019 09:30am - 12:30pm	Snorkel	24	2	5	20	Low	Flood	1.5 m	Weak	Large Rocky Reef (>2m), Sand/Mud, Kelp, Mixed Algae, Seagrass, Sponges, Seasquirts & Other
Point Cooke Marine Sanctuary	Point Cooke Marine Sanctuary Care and Parks Victoria	18/01/2020 10:30am - 11:30am	Snorkel	13	2	1	0	High	Ebb	0 m	Weak	Low Rocky Reef (<2m), Sand/Mud, Mixed Algae, Seagrass
<b>Eastern Victoria</b>												
Gippsland Lakes (Scone Point)	Friends of Beware Reef	18/11/2019 10:00am - 11:00am	SCUBA and Snorkel	6	4	3	18	High	Slack	0 m	Nil	Low Rocky Reef (<2m), Sand/Mud, Seagrass
Gippsland Lakes (Nyerimilang Jetty)	Friends of Beware Reef	18/11/2019 11:00am - 12:45pm	SCUBA	2	4	4	18	High	Slack	0 m	Nil	Artificial Reef, Rubble, Sand/Mud, Sponges, Seasquirts & Other
Gippsland Lakes (The Stumps)	Friends of Beware Reef	18/11/2019 12:00pm - 01:30pm	Snorkel	6	1	7	18	High	Flood	0 m	Nil	Sand/Mud, Seagrass
Shack Bay	South Gippsland Conservation Society - Bunurong Coast Education	24/11/2019 02:45pm - 03:30pm	Snorkel	23	5	3	16	Low	Flood	1 m	Weak	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other
Harmers Haven	South Gippsland Conservation Society & Friends of Harmers Haven	8/12/2019 01:45pm - 02:15pm	Snorkel	19	6	4	16	Low	Ebb	0.5 m	Weak	Large Rocky Reef (>2m), Low Rocky Reef (<2m), Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other



## VII: Table of survey variables and species observed at Rye Pier (see Figure 15)

Survey Date	Time	Group	Habitat Type	Survey Method	No. of Participants	Max. Depth (m)	Visibility (m)	Water Temperature (°C)	Tide	Tidal Stream	Current	Target Species (Abundance)
21/11/2015	-	Scuba Culture	Low Rocky Reef (<2m), Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	8	4.7	8	18	High	Slack	Weak	Blue Throat Wrasse 20+ Sea Sweep 6-20 Victorian Scalyfin 1-5 Zebra Fish 1-5
28/11/2015	-	Scuba Culture	Low Rocky Reef (<2m), Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	6	4.4	4	17	Low	Ebb	Nil	Bastard Trumpeter 6-20 Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Sea Sweep 1-5 Six-spinned Leatherjacket 6-20 Victorian Scalyfin 6-20
5/12/2015	-	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	8	4.8	5	18	Low	Slack	Weak	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Sea Sweep 6-20 Senator Wrasse 1-5 Silver Sweep 1-5 Six-spinned Leatherjacket 6-20 Victorian Scalyfin 1-5 Zebra Fish 1-5
6/12/2015	-	Dive and Dive	Artificial Reef, Kelp, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	17	8	10	19	High	-	Nil	Bastard Trumpeter 6-20 Blue Throat Wrasse 20+ Dusky Morwong 1-5 Horseshoe Leatherjacket 6-20 Maggie Perch 20+ Old Wife 1-5 Ornate Cowfish 1-5 Senator Wrasse 6-20 Silver Sweep 6-20 Six-spined Leatherjacket 6-20 Victorian Scalyfin 1-5 Zebra Fish 1-5
27/11/2016	10:11am - 11:00am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	6	4.7	8	-	High	Flood	Weak	Blue Throat Wrasse 20+ Dusky Morwong 1-5 Horseshoe Leatherjacket 6-20 Maggie Perch 1-5 Senator Wrasse 1-5 Six-spined Leatherjacket 1-5 Zebra Fish 1-5

3/12/2016	10:01am - 10:48am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	7	4.6	5	17	High	Ebb	Weak	Blue Throat Wrasse 20+ Dusky Morwong 1-5 Horseshoe Leatherjacket 6-20 Magpie Perch 1-5 Sea Sweep 20+ Senator Wrasse 1-5 Six-spined Leatherjacket 6-20
3/12/2016	11:00am - 02:00pm	Dive and Dive	Artificial Reef, Kelp, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA & Snorkel	16	8	6	18	-	-	-	Bastard Trumpeter 6-20 Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Magpie Perch 20+ Senator Wrasse 6-20 Silver Sweep 6-20 Six-spined Leatherjacket 1-5 Victorian Scalyfin 1-5
10/12/2016	10:08am - 10:53 am	Scuba Culture	Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	5	5.1	4	17	Low	Slack	Weak	Blue Throat Wrasse 20+ Dusky Morwong 1-5 Horseshoe Leatherjacket 6-20 Magpie Perch 1-5 Sea Sweep 6-20 Six-spined Leatherjacket 6-20 Victorian Scalyfin 1-5 Zebra Fish 1-5
18/11/2017	10:05am - 10:51am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	3	5	5	19	Low	Flood	Weak	Black stingray 1-5 Blue Throat Wrasse 20+ Horseshoe Leatherjacket 20+ Magpie Perch 1-5 Saddled Wrasse 1-5 Sea Sweep 20+ Senator Wrasse 1-5 Six-spined Leatherjacket 1-5 Southern Eagle Ray 1-5 Victorian Scalyfin 6-20
18/11/2017	11:00am - 12:05pm	Wild Families	Artificial Reef, Rubble, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	Snorkel	14	5	10	17	Mid	Flood	Weak	Blue Throat Wrasse 6-20 Dusky Morwong 1-5 Horseshoe Leatherjacket 6-20 Magpie Perch 1-5 Saddled Wrasse 1-5 Smooth stingray 1-5 Southern Fiddler Ray 1-5
18/11/2017	12:00pm - 12:40pm	Dive La Trobe	Artificial Reef, Sand/Mud, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	10	7	10	15	Mid	Flood	Weak	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Magpie Perch 6-20 Ornate Cowfish 1-5 Silver Sweep 20+ Six-spined Leatherjacket 20+ Smooth stingray 1-5 Victorian Scalyfin 1-5



19/11/2017	-	Academy of Scuba	-	SCUBA	15	5	7	-	-	-	-	Banded Morwong 1-5 Bastard Trumpeter 1-5 Blue Throat Wrasse 6-20 Herring Cale 1-5 Horseshoe Leatherjacket 1-5 Maori Wrasse 1-5 Ornate Cowfish 1-5 Saddled Wrasse 1-5 Sea Sweep 1-5 Senator Wrasse 1-5 Shaw's Cowfish 1-5 Silver Sweep 1-5 Six-spined Leatherjacket 1-5 Smooth stingray 1-5 Southern Fiddler Ray 1-5 Spotted stingaree 1-5 Zebra Fish 1-5
25/11/2017	09:43am - 10:30am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	4	5	5	20	Low	Ebb	Weak	Black stingray 1-5 Blue Throat Wrasse 20+ Herring Cale 1-5 Horseshoe Leatherjacket 6-20 Maggie Pearch 1-5 Sea Sweep 20+ Senator Wrasse 1-5 Six-spined Leatherjacket 6-20 Victorian Scalyfin 6-20
9/12/2017	09:50am - 10:36 am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	3	5	4	18	High	Ebb	Strong	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 1-5 Sea Sweep 6-20 Six-spined Leatherjacket 6-20 Victorian Scalyfin 1-5
17/11/2018	09:30am - 01:00pm	Scuba Culture	Artificial Reef, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	9	7	10	16	High	Flood	Weak	Banded Morwong 1-5 Sea Sweep 1-5 Smooth stingray 1-5 Victorian Scalyfin 1-5

17/11/2018	01:00pm - 01:45pm	Dive and Dive	Artificial Reef, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	5	8	10	17	High	Flood	Nil	Blue Throat Wrasse 20+ Maggie Pearch 6-20 Old Wife 6-20 Saddled Wrasse 6-20 Senator Wrasse 1-5 Shaw's Cowfish 1-5 Six-spined Leatherjacket 6-20 Smooth stingray 1-5 Blue Throat Wrasse 20+ Maggie Pearch 6-20 Old Wife 6-20 Saddled Wrasse 6-20 Senator Wrasse 1-5 Shaw's Cowfish 1-5 Six-spined Leatherjacket 6-20 Smooth stingray 1-5
25/11/2018	11:00am - 12:00pm	DIVE2U	Low rocky reef (<2m), Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	Snorkel	4	4	7	17	Low	Flood	Nil	Blue Throat Wrasse 20+ Maggie Perch 1-5 Old Wife 1-5 Senator Wrasse 1-5 Smooth stingray 1-5 Spotted stingaree 1-5 Zebra Fish 1-5
01/12/2018	09:00am - 12:30pm	Scuba Culture	Artificial Reef, Mixed Algae, Sponges, Seasquirts & Other	SCUBA	2	7	4	17	High	Ebb	Weak	Blue Throat Wrasse 1-5 Dusky Morwong 1-5 Maggie Perch 1-5 Sea Sweep 1-5 Senator Wrasse 1-5 Six-spined Leatherjacket 1-5 Smooth stingray 1-5 Victorian Scalyfin 1-5
9/12/2018	10:30am - 11:30am	Academy of Scuba	Artificial Reef, Rubble, Kelp, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	7	7	10	19	High	Slack	Nil	Banded Morwong 20+ Bastard Trumpeter 1-5 Blue Throat Wrasse 20+ Dusky Morwong 1-5 Eastern Blue Groper 1-5 Horseshoe Leatherjacket 1-5 Long-snouted Boarfish 1-5 Maggie Perch 1-5 Old Wife 1-5 Ornate Cowfish 1-5 Saddled Wrasse 6-20 Sea Sweep 1-5 Senator Wrasse 1-5 Shaw's Cowfish 1-5 Six-spined Leatherjacket 1-5 Southern Eagle Ray 1-5 Southern Fiddler Ray 1-5 Zebra Fish 1-5



15/12/2018	09:53am - 10:39am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	9	4.8	8	19	High	Ebb	Weak	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Maggie Perch 1-5 Old Wife 1-5 Sea Sweep 20+ Senator Wrasse 1-5 Six-spined Leatherjacket 1-5 Smooth stingray 1-5 Southern Fiddler Ray 1-5 Victorian Scalyfin 6-20 Zebra Fish 1-5
16/11/2019	10:20am - 11:24pm	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	5	5	10	14	Low	Flood	Nil	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Maggie Perch 1-5 Sea Sweep 6-20 Senator Wrasse 1-5 Six-spined Leatherjacket 6-20 Smooth stingray 1-5 Southern Fiddler Ray 1-5 Victorian Scalyfin 1-5 Zebra Fish 1-5
23/11/2019	10:19am - 11:25am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	5	5	6	16	Mid	Flood	Nil	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 20+ Sea Sweep 6-20 Senator Wrasse 1-5 Six-spined Leatherjacket 6-20 Smooth stingray 1-5 Southern Fiddler Ray 1-5 Victorian Scalyfin 1-5
24/11/2019	11:00am - 12:00pm	Dive2U & Wild Families	Artificial Reef, Sand/Mud, Kelp, Mixed Algae	Snorkel	9	4	5	17	High	Slack	Nil	Blue Throat Wrasse 1-5 Dusky Morwong 1-5 Horseshoe Leatherjacket 1-5 Saddled Wrasse 1-5 Smooth stingray 1-5 Southern Fiddler Ray 1-5 Zebra Fish 1-5
24/11/2019	01:10pm - 02:10pm	Dive2U & Wild Families	Artificial Reef, Sand/Mud, Kelp, Mixed Algae, Sponges, Seasquirts & Other	Snorkel	16	4	5	17	High	Ebb	Nil	Blue Throat Wrasse 1-5 Dusky Morwong 1-5 Herring Cale 1-5 Horseshoe Leatherjacket 1-5 Maggie Pearch 1-5 Ornate Cowfish 1-5 Saddled Wrasse 1-5 Sea Sweep 1-5 Six-spined Leatherjacket 1-5 Southern Fiddler Ray 1-5 Zebra Fish 6-20

30/11/2019	10:16am - 11:10pm	Aquatic Adventures	Artificial Reef, Sand/Mud, Mixed Algae, Seagrass, Sponges, Seasquirts & Other	SCUBA	15	5	15	14	Low	Flood	Nil	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 6-20 Magpie Perch 1-5 Sea Sweep 6-20 Senator Wrasse 6-20 Shaw's Cowfish 1-5 Six-spined Leatherjacket 6-20 Smooth stingray 1-5 Southern Fiddler Ray 1-5 Spotted stingaree 1-5 Victorian Scalyfin 1-5 Zebra Fish 6-20
30/11/2019	10:19am - 11:17am	Scuba Culture	Artificial Reef, Rubble, Sand/Mud, Mixed Algae, Seagrass, Sponges, Seasquirts & )ther	SCUBA	12	5	8	16	Mid	Flood	Nil	Blue Throat Wrasse 20+ Horseshoe Leatherjacket 20+ Magpie Perch 1-5 Maori Wrasse 1-5 Ornate Cowfish 1-5 Saddled Wrasse 1-5 Sea Sweep 20+ Senator Wrasse 1-5 Shaw's Cowfish 1-5 Six-spined Leatherjacket 20+ Southern Fiddler Ray 1-5 Spotted stingaree 1-5 Victorian Scalyfin 1-5 Zebra Fish 20+
15/12/2019	02:10pm - 03:10pm	Dive and Dive	Sand/Mud, Mixed algae, Sponges, Seasquirts & Other	SCUBA	6	4.6	8	16	High	Flood	Strong	Blue Throat Wrasse 20+ Dusky Morwong 1-5 Herring Cale 6-20 Horseshoe Leatherjacket 1-5 Magpie Perch 6-20 Saddled Wrasse 1-5 Sea Sweep 20+ Senator Wrasse 6-20 Silver Sweep 6-20 Six-spined Leatherjacket 20+ Smooth stingray 1-5 Spotted wobbegong 1-5 Victorian Scalyfin 6-20



