

Parks Victoria Research Partners Panel Project Summary Report



An integrated monitoring program for Port Phillip Heads Marine National Park Parks Victoria and Deakin University

Background

Parks Victoria has established the Signs of Healthy Parks (SHP) program for its network of marine national parks and sanctuaries with the aim of both improving baseline knowledge of Victoria's marine protected areas (MPAs) and addressing applied management questions. The program aims to ensure systematic, robust and integrated ecological monitoring across the breadth of Victoria's marine national parks and sanctuaries. Parks Victoria has implemented subtidal and intertidal reef monitoring programs in a large number of its MPAs from as far back as 1998; however, they only cover a small proportion of the key habitats in the parks. Using advances in ocean technology, and through collaborative research partnership with Deakin University the SHP program can now monitor the health of the entire extent of parks, allowing the full gamut of protected features to be monitored. Building on Parks Victoria's Conservation Action Planning process and historical monitoring programs, the SHP aims to monitor the health of protected areas using a range of environmental indicators that provide information about natural values and ecological processes occurring within the parks and potential threats. This study implemented a suite of monitoring approaches to assess the health and condition of the no-take Port Phillip Heads Marine National Park and address key knowledge gaps. This study assessed the area within and adjacent to 3 of the 6 sections of Port Phillip Head MNP sections: Point Lonsdale (377 ha), Point Nepean (377 ha) and Popes Eye (The Annulus; 3.1 ha) by integrating historical data collections dating from the late 1990s with new collections in 2018 and 2019.

Port Phillip Heads MNP encompasses a diverse range of environmental settings including high energy open coast, sheltered areas inside Port Phillip Bay, high exposure to tidal currents and large depth ranges, spanning from the intertidal zone to approximately 100 m deep in the Port Phillip Bay entrance canyon. These diverse environmental conditions support a large variety of habitat types. The subtidal reefs within Port Phillip Heads MNP provide habitat for a diverse and colourful community of sessile invertebrates (including sponges, hydroid species, gorgonians, soft corals, jewel anemones, yellow zoanths, hard corals, encrusting and bushy bryozoans and ascidians), mobile invertebrates (including abalone, urchins, nudibranchs, sea stars, feather stars and rock lobsters) and algae (including kelp forest and diverse brown and red algal beds).

Aims

The aim of this project was to:

- assess changes in sea-surface temperature in Port Phillip Head Marine National Park using data sourced from the Integrated Marine Observing System (IMOS)

Relevant parks and ecosystems

Port Phillip Heads Marine National Park

More information

Contact Parks Victoria on 13 1963

Publications and presentations

Ierodiaconou D, Young M, Wines S, Carnell P, Tinkler P, Allan B, Whitmarsh S, Howe S, Pocklington J 2022. An integrated monitoring program for Port Phillip Heads Marine National Park. Parks Victoria Technical Series 117.

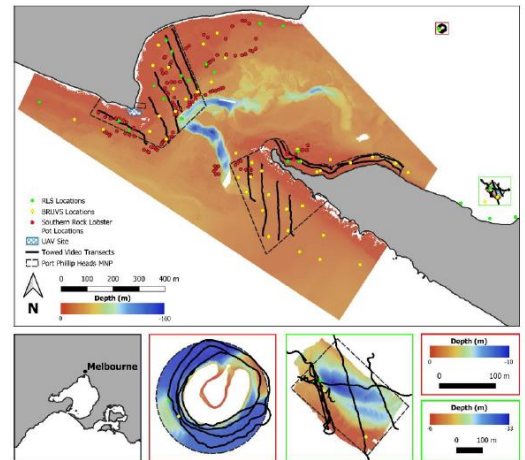
Murfitt, S.L., Allan, B.M., Bellgrove, A. et al. Applications of unmanned aerial vehicles in intertidal reef monitoring. *Sci Rep* 7, 10259 (2017). <https://doi.org/10.1038/s41598-017-10818-9>



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- implement a baited remote underwater video stations (BRUVS) survey of fish assemblages within and adjacent to the MPA and combine survey data with spatially explicit distribution modelling techniques to understand the effect of seafloor structure and the effectiveness of no-take protection on the abundance and diversity of fish
- combine data collected from underwater visual census (diver surveys) for this project and from related programs (e.g. data collected by Reef Life Survey volunteers and historical programs) to understand trends in abundance through time for key species of fish, mobile invertebrates and macroalgal species in Port Phillip Heads MNP
- use standardised fishery stock assessment methods to assess the effects of no-take protection, seafloor structure and distance from Port Phillip Head MNP on the local population of Southern Rock Lobster (*Jasus edwardsii*).
- implement unmanned aerial vehicle (UAV) surveys and visual census surveys for habitat-forming species and mobile invertebrates for intertidal reef platforms to estimate the distribution and change over time of the key habitat forming algae *Hormisora banksii* and mobile invertebrates
- develop and implement robust survey designs for brown macroalgal-dominated communities on deeper reefs (>10 m depth) and key ecological attributes (sessile invertebrate communities in Portsea Hole) on deeper reefs using towed video and downward-facing still images
- conduct multibeam sonar surveys and ground truth video to produce habitat maps for Portsea Hole and Popes Eye

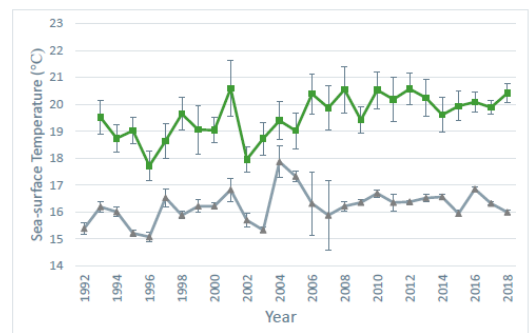


Locations of Reef Life Survey transects (green points), Southern Rock Lobster pots (red points), baited remote underwater video station (BRUVS) deployments (yellow points), unmanned aerial vehicle (UAV) survey extent (blue shape), and towed video transects (black full line) across the entire study site. The dashed line indicates the boundaries of the Port Phillip Heads MNP. Sites are overlaid on high-resolution hillshaded (shading to show 3D relief) bathymetry of the area coloured by depth. Note: All Reef Life Survey locations also had BRUVS deployments.

Results

Sea Surface Temperature in Port Phillip Heads MNP has experienced an overall mean increase since 1992 in both annual and summer time series, but this trend is not linear. Summer exhibited higher temperature variability over time. Summer temperatures have also increased in recent years while annual temperatures have experienced a slight decrease following a spike in 2004

Fish assemblages within and adjacent to the Port Phillip Heads MNP were observed using a range of methods throughout this study. BRUV surveys found that the most abundant species in Port Phillip Heads were the Bluethroat Wrasse (*Notolabrus tetricus*, 28.4%), Sixspine Leatherjacket (*Meuschenia freycineti*, 7.0%), Zebrafish (*Girella zebra* (5.4%), Horseshoe Leatherjacket (*Meuschenia hippocrepis* 5.2%), Snapper (*Chrysophrys auratus*, 4.9%), Senator Wrasse (*Pictilabrus laticlavius*, 4.9%) and Southern Fiddler Ray (*Trygonorrhina dumerilii*, 4.6%). Shark and ray species contribute the greatest biomass in the MNP, with Smooth Stingray (*Bathytoshia brevicaudata*, 57.7%), Southern Eagle Ray (*Myliobatis tenuicaudatus*, 16.3%), Southern Fiddler Ray, (*Trygonorrhina dumerilii*, 8.2%) and Port Jackson Shark (*Heterodontus portusjacksoni*, 2.7%) made up



Sea-surface temperature (SST) trends through time for annual (grey line) and summer (green line) means in the Port Phillip Heads MNP. Error bars show the standard deviations of the means across the park

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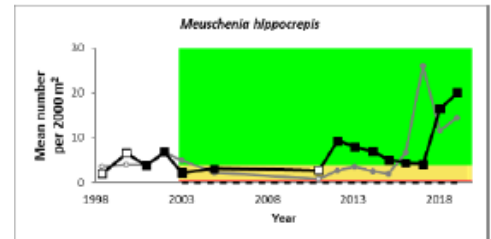
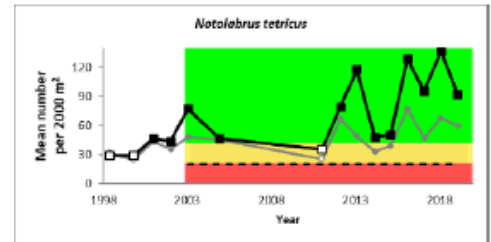
a combined 84.9% of the total biomass observed. Species distribution models using BRUV and environmental data were effective for modelling species richness and the habitat preferences of several key species. Fish species richness was found to increase as depth, ruggedness of terrain and current speed increased.

Results from long term underwater visual census data showed the current status of all key mobile fish species to be healthy and in good condition. Species such as the Bluethroat Wrasse (*Notolabrus tetricus*) and Horseshoe Leatherjacket (*Meuschenia hippocrepis*) showed increases in the mean number present in the marine national park after its declaration (in 2002), indicative of benefits of no-take protection for fish populations. Fish species richness (averaged across the 2016–19 surveys) was found to be highest at Popes Eye and South Channel Fort.

Populations of key mobile invertebrates such as the Greenlip Abalone (*Haliotis laevis*) and Orange Feather Star (*Cenolia trichoptera*) are in good condition. Benefits of protection were observed for Greenlip Abalone which had higher numbers inside the marine national park and has shown an increase since declaration of the MNP both inside the park and at reference sites. However, consistent declines over the last 13 years were observed in Blacklip Abalone (*Haliotis rubra*) and Southern Biscuit Star (*Tosia australis*) both inside and outside the park, indicating that drivers of decline are occurring at larger scales than the park itself. Higher numbers of Blacklip Abalone were found within the parks, indicating some benefits of protection despite long term declines. Abundances of the Purple Sea Urchin (*Heliocidaris erythrogramma*) have been low since 1998. In this case, low number of the Purple Urchin are likely a sign of good health, as this species can overgraze kelp to the extent that ‘barren’ areas are created when abundances become too high.

Key macroalgal species are in either fair or good condition in Port Phillip Heads MNP. However, coverage of the major canopy forming Golden Kelp (*Ecklonia radiata*) has declined since its high in 2002 and has consistently had a lower percentage cover inside the park than in the reference sites. Its percentage cover within the park declined dramatically to around 5% in 2016–17, but this decline was not seen in the reference areas. However, in recent years percentage cover of *E. radiata* within the park has increased. Percentage cover of *Phyllospora comosa*, another important canopy-forming species, has also gradually decreased over time, but it has seen a recent uptick in 2019 within the park. Outside the park, *P. comosa* has followed the same trends but with much lower overall percentage cover across the entire time series compared to inside the park.

Southern Rock Lobster numbers were very low in the Port Phillip Heads regions with only 17 lobsters caught within the protected waters of Port Phillip Head MNP compared with 8 in fished waters. Although more lobster was caught within the MPA, statistical analysis couldn’t be undertaken to confirm whether differences were meaningful due to the low number of individuals caught. No lobsters caught inside or outside the MPA were



Control charts showing change in abundance of key mobile fish species within the Port Phillip Heads MNP (black line) and reference sites outside the park (grey line). These charts have a lower limit of acceptable change (LLAC, top of the yellow band – set as the minimum value inside the MPA from SRMP surveys from 1998 to 2002) and lower control limit (LCL, dashed line at top of red band) based on the variation from surveys, which indicate the level at which conditions are sufficiently poor that some management response is required



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under legal size. Lobsters caught within the park were found to be on average slightly smaller than those caught in fished areas.

Unmanned aerial vehicle (UAV) surveys of intertidal platforms were found to produce comparable results to visual survey methods. Results from combined UAV and visual census data showed that *H. banksii* cover was in good condition.

Habitat classification maps were created for Portsea Hole and Popes Eye based on the relationships found between habitat types and seafloor characteristics using georeferenced imagery and multi beam sonar mapping. At Popes Eye, reefs are dominated by the Golden Kelp *Ecklonia radiata* while the sediment areas contain a sparse mix of sponges and algal species. In contrast, Portsea Hole is mainly made up of either bare sediment or sediment covered in seagrass or macroalgae. Reef within Portsea Hole is predominantly in the form of a vertical wall, which means it only takes up a small horizontal area of the park (3%) and is hard to classify, though underwater visual census surveys found this habitat to contain diverse habitat types.

Implications

It will be critical to continue monitoring and research programs to understand the impacts and changes to the key ecological attributes of the park from increasing sea surface temperatures detected in this study

The healthy fish populations and increases in abundance since declaration for some key species within Port Phillip Heads MNP indicate that populations are being effectively protected by the park. Ongoing compliance and enforcement to prevent illegal take will be important to maintain healthy populations.

This study has also established a baseline for building a time series to monitor fish assemblages over the entire depth range of Port Phillip Heads MNP using BRUVs and more comprehensively track fish population health through time. BRUVs also enabled sampling at greater depths than the underwater visual census methods used in historic monitoring programs, which provides a stronger characterisation of fish assemblages in MPAs.

The distribution modelling approaches based on BRUV data used in this study enhance our ability to predict patterns in abundance and biodiversity beyond sampled locations. Distribution modelling can be used for a range of applications such as identifying critical habitat or locations within MPAs for species of management interest, identifying sites of high biodiversity to focus protection efforts or researching effects of environmental change.

Continuing the underwater water visual census at key subtidal monitoring sites has enabled understanding of long terms trends in key fish, mobile invertebrate and macroalgal species. The mixed responses of key mobile species indicate that protection provided by the park is beneficial for some species, but further investigation is required to understand major declines in ecologically important species like the Blacklip Abalone.

Long term declines in major canopy forming macroalgae observed in Port Phillip Head MNP requires further attention and ongoing monitoring to



Screen grabs from high-definition BRUVS video exhibiting the diversity of habitat and species that can be sampled by this method



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understand drivers and consequences of macroalgal loss and to determine appropriate management interventions.

Low numbers of Southern Rock Lobster found in Port Phillip Heads MNP could be related to its close proximity to the heavily populated Melbourne area. There is likely to be greater recreational fishing of SRL in the areas of Port Phillip Bay surrounding the park than in more isolated locations along the coast. Poaching within the marine national park could also be occurring, reducing numbers. A compliance and enforcement program aimed at preventing illegal fishing and take of Southern Rock Lobster is needed to support an increase in populations.

