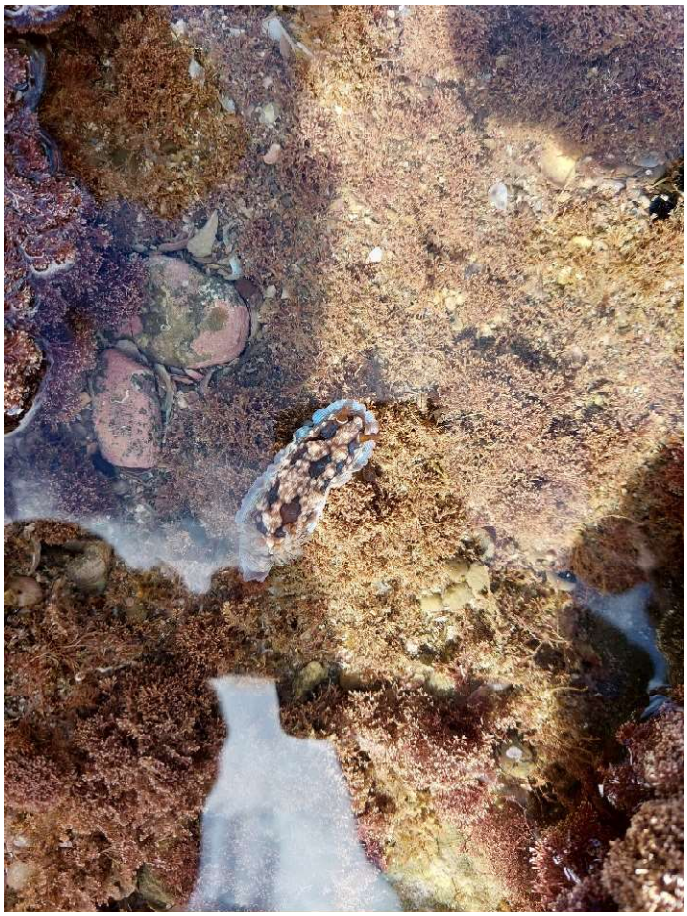
Hauraki Gulf Monitoring Project

Science Report 2022



Left: Community Event data collection at Okura (Long Bay) Marine Reserve in collaboration with the Sir Peter Blake Marine Education and Recreation Centre (MERC).

Right: Gem Nudibranch (Dendrodoris krusensternii) found at Okura Marine Reserve

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NEW ZEALAND
MARINE STUDIES CENTRE
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Executive Summary

The Hauraki Gulf Monitoring Project (HGMP) is a coastal monitoring project that uses citizen science to gather information on biodiversity of the intertidal community of the Hauraki Gulf – Tīkapa Moana. The HGMP uses the Marine Metre Squared (Mm2) methods (www.mm2.net.nz) to collect data on the diversity, abundance, and distribution of invertebrates and seaweeds and small fish living between the tides. The project began in 2017

and this report summarizes the finding and outcomes of the collected data in 2021.

Some key highlights include:

- Nine school groups participated
- Seven workshops for teachers/educators
- One community event was held in collaboration with MERC
- Ten locations around the Hauraki Gulf were monitored
- Four sites were monitored for at least their second time
- 121 unique species were identified
- One invasive marine pest was recorded at two locations

This project would not be possible without the engagement and enthusiasm of the schools and community groups involved nor without the support of Foundation North, the New Zealand Association for Environmental Education (NZAEE), the New Zealand Marine Studies Centre, Sir Peter Blake Marine Education and Recreation Centre and the past co-coordinators of the project Dr Mels Barton, Shanthie Walker and Aless Smith

Contents

Executive Summary 2
Introduction 4
Methods 6
Results/Discussion 8
Species Richness 8
Invasive species 8
Trophic Levels 11
Data over time 13
Summary 14
References 17

Introduction

The Hauraki Gulf Marine Park or Tīkapa Moana lies on the east coast of the Auckland and Waikato and covers an area of more than 1.2 million hectares (Department of Conservation, n.d.). Being located near the densest population of people in Aotearoa, Auckland having a population of 1.66 million in 2017 (Council, n.d.). Tīkapa Moana is a hub of human activities ranging from general recreation to tourist activities like kayaking, boating, snorkelling as well as ferries and trips to the many offshore islands (New Zealand Tourism, n.d.). Tīkapa Moana also serves as a popular location for both recreational and commercial fisheries. Under these anthropogenic impacts, the biodiversity of the Hauraki Gulf have come under threat (Hauraki Gulf Forum, 2020). This has, in turn, threatened the value of the Marine Park as a source of kaimoana and recreation which support the physical and mental health of the people who are connected to this environment.

The 2020 "State of Our Gulf" report outlines the decline that kaimoana stocks such as crayfish and snapper are experiencing and the flow on effects for the biodiversity of the ecosystems within the gulf as kina/urchin barrens become more common (Hauraki Gulf Forum, 2020). It is due to the concern for this space and the species which call it home as well as a desire to engage the public in the health of this environment that the Hauraki Gulf Monitoring Project (HGMP) was started.

The Hauraki Gulf Monitoring Project (HGMP) was established in 2017 when Foundation North provided funding to the New Zealand Association for Environmental Education (NZAEE). Seeing a need to further engage with communities (particularly young people) in becoming kaitaiki/guardians of the Hauraki Gulf – Tīkapa Moana/ Te Moananui-ā-Toi, the HGMP builds upon the annual event 'Seaweek'(also run by the NZAEE). The HGMP aims to encourage our connection with the coastal environment, develop an ethos of guardianship/kaitiakitanga and support environmental action projects to increase understanding how our activities affect the coastal environment.

To achieve these goals, the HGMP has utilised Marine Metre Squared (Mm2) as a tool for monitoring seashore ecology over time. Mm2 is a nationwide marine-focussed monitoring project that relies on the general public to gather information about what is living on their local seashore. Using a standard ecological surveying method, Mm2 is an effective way to encourage communities to look closer, get to know their local seashore and monitor change

over time. This demonstration of citizen science – where the public participates in a scientific project (often through data collection) – can create partnerships between sectors, promote environmental awareness, involved local communities in science and kaitiakitanga/guardianship.

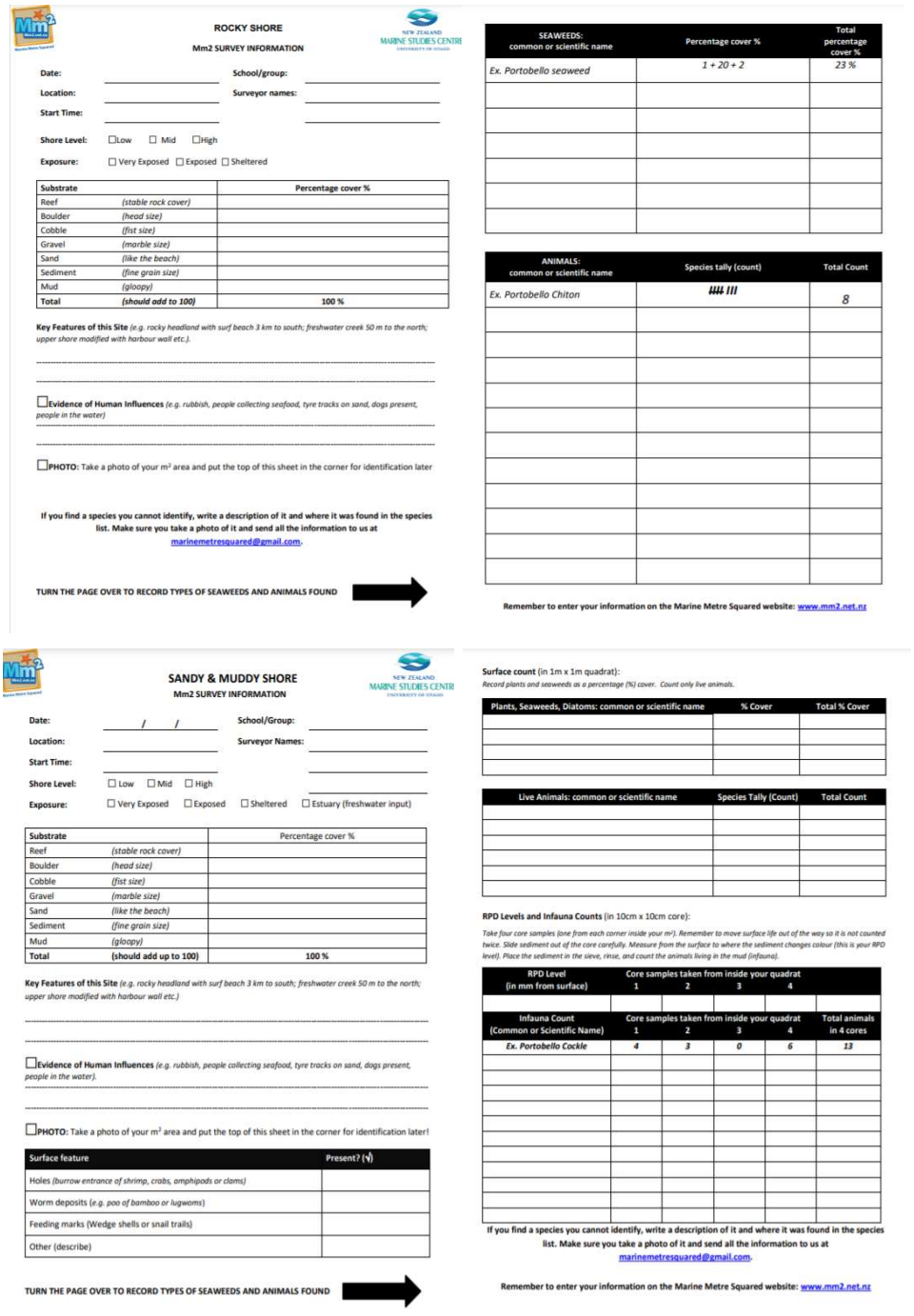
Through collecting data, participants not only have the opportunity to develop practical science skills but also gather data for useful measures of ecosystem health such as biodiversity, species abundance and distribution. Collection of baseline data is very valuable for long-term ecological monitoring and provides the opportunity to look at change in the biological community over time or other ecological parameters. It provides schools and community groups with a procedure to investigate questions that are of local concern and encourages them to regularly check the health of their local shore through monitoring.

The collection of data over time can help to serve as an early warning system for environmental change for managers. Data collected by citizen scientists can also be used to supplement data collected by other groups. As an issue of concern in the Hauraki Gulf is the impact of both terrestrial and waterborne human activities on the quality of Tīkapa Moana as a habitat for biodiversity. To address this, the aim for this year was to link the Mm2 data collected by participating groups to observations of human influences around the chosen site and how these might be impacting the local marine life.

This report presents the data collected in the 2022 iteration of the HGMP.

Methods

Marine metre squared data is collected using a standardised method where groups follow a data collection protocol given in the data sheets. The sheets are customised for sampling on rocky and sand shores there are shown in figure 1 below.



ROCKY SHORE

Mm2 SURVEY INFORMATION

NEW ZEALAND MARINE STUDIES CENTRE

Date: School/group:

Location: Surveyor names:

Start Time:

Shore Level: ☐Low ☐ Mid ☐High

Exposure: ☐ Very Exposed ☐ Exposed ☐ Sheltered

Substrate		Percentage cover %
Reef	(stable rock cover)	
Boulder	(head size)	
Cobble	(fist size)	
Gravel	(marble size)	
Sand	(like the beach)	
Sediment	(fine grain size)	
Mud	(gloopy)	
Total	(should add to 100)	100 %

Key Features of this Site *(e.g. rocky headland with surf beach 3 km to south; freshwater creek 50 m to the north; upper shore modified with harbour wall etc.).*

☐**Evidence of Human Influences** *(e.g. rubbish, people collecting seafood, tyre tracks on sand, dogs present, people in the water)*

☐**PHOTO:** Take a photo of your m² area and put the top of this sheet in the corner for identification later

If you find a species you cannot identify, write a description of it and where it was found in the species list. Make sure you take a photo of it and send all the information to us at marinemetresquared@gmail.com.

TURN THE PAGE OVER TO RECORD TYPES OF SEAWEEDS AND ANIMALS FOUND

SEAWEEDS: common or scientific name	Percentage cover %	Total percentage cover %
Ex. Portobello seaweed	*1 + 20 + 2*	*23 %*

ANIMALS: common or scientific name	Species tally (count)	Total Count
Ex. Portobello Chiton	*𝍸 III*	*8*

Remember to enter your information on the Marine Metre Squared website: www.mm2.net.nz

SANDY & MUDDY SHORE

Mm2 SURVEY INFORMATION

NEW ZEALAND MARINE STUDIES CENTRE

Date: / / School/Group:

Location: Surveyor Names:

Start Time:

Shore Level: ☐ Low ☐ Mid ☐ High

Exposure: ☐ Very Exposed ☐ Exposed ☐ Sheltered ☐ Estuary (freshwater input)

Substrate		Percentage cover %
Reef	(stable rock cover)	
Boulder	(head size)	
Cobble	(fist size)	
Gravel	(marble size)	
Sand	(like the beach)	
Sediment	(fine grain size)	
Mud	(gloopy)	
Total	(should add up to 100)	100 %

Key Features of this Site *(e.g. rocky headland with surf beach 3 km to south; freshwater creek 50 m to the north; upper shore modified with harbour wall etc.)*

☐**Evidence of Human Influences** *(e.g. rubbish, people collecting seafood, tyre tracks on sand, dogs present, people in the water).*

☐**PHOTO:** Take a photo of your m² area and put the top of this sheet in the corner for identification later!

Surface feature	Present? (✓)
Holes (burrow entrance of shrimp, crabs, amphipods or clams)	
Worm deposits (e.g. poo of bamboo or lugworms)	
Feeding marks (Wedge shells or snail trails)	
Other (describe)	

TURN THE PAGE OVER TO RECORD TYPES OF SEAWEEDS AND ANIMALS FOUND

Surface count (in 1m x 1m quadrat):

Record plants and seaweeds as a percentage (%) cover. Count only live animals.

Plants, Seaweeds, Diatoms: common or scientific name	% Cover	Total % Cover

Live Animals: common or scientific name	Species Tally (Count)	Total Count

RPD Levels and Infauna Counts (in 10cm x 10cm core):

Take four core samples (one from each corner inside your m²). Remember to move surface life out of the way so it is not counted twice. Slide sediment out of the core carefully. Measure from the surface to where the sediment changes colour (this is your RPD level). Place the sediment in the sieve, rinse, and count the animals living in the mud (infauna).

RPD Level (in mm from surface)	Core samples taken from inside your quadrat 1	2	3	4	
Infauna Count (Common or Scientific Name)	**Core samples taken from inside your quadrat 1**	**2**	**3**	**4**	**Total animals in 4 cores**
Ex. Portobello Cockle	***4***	***3***	***0***	***6***	***13***

If you find a species you cannot identify, write a description of it and where it was found in the species list. Make sure you take a photo of it and send all the information to us at marinemetresquared@gmail.com.

Remember to enter your information on the Marine Metre Squared website: www.mm2.net.nz

Figure 1. Data collection sheets for both Rocky (top) and Sandy (bottom) shores.

In 2022 nine school groups and seven community/teacher groups participated in the HGMP from Whangaparaoa to Maraetai (figure 2). Pakuranga College surveyed Eastern Beach, Farm Cove School surveyed Bramley Drive Beach, Maraetai Beach School surveyed Omana Beach in August. In September, Takapuna Beach was surveyed by AGE School, Te Atatu Intermediate surveyed Orangihina Park whilst Wentworth College surveyed at Tindall's Beach. The Islands of Tīkapa Moana were also surveyed this year with Waiheke Primary surveying in the Whakanewha Regional Park on Waiheke Island, Mulberry Grove School surveying Mulberry Grove Beach on Aotea (Great Barrier) Island, and in collaboration with the Rotoroa Island Education group a survey was completed at Ladies Bay on Rotoroa Island. In addition to these a community event was run in collaboration with MERC at Okura (Long Bay) Marine Reserve. Three teacher workshops took place at Campbells Bay and Westmere Park. To analyse the data collected this year, species diversity was calculated, and species were placed into trophic groups. Observations of the Mediterranean Fan Worm (MFW) were also compared over time.

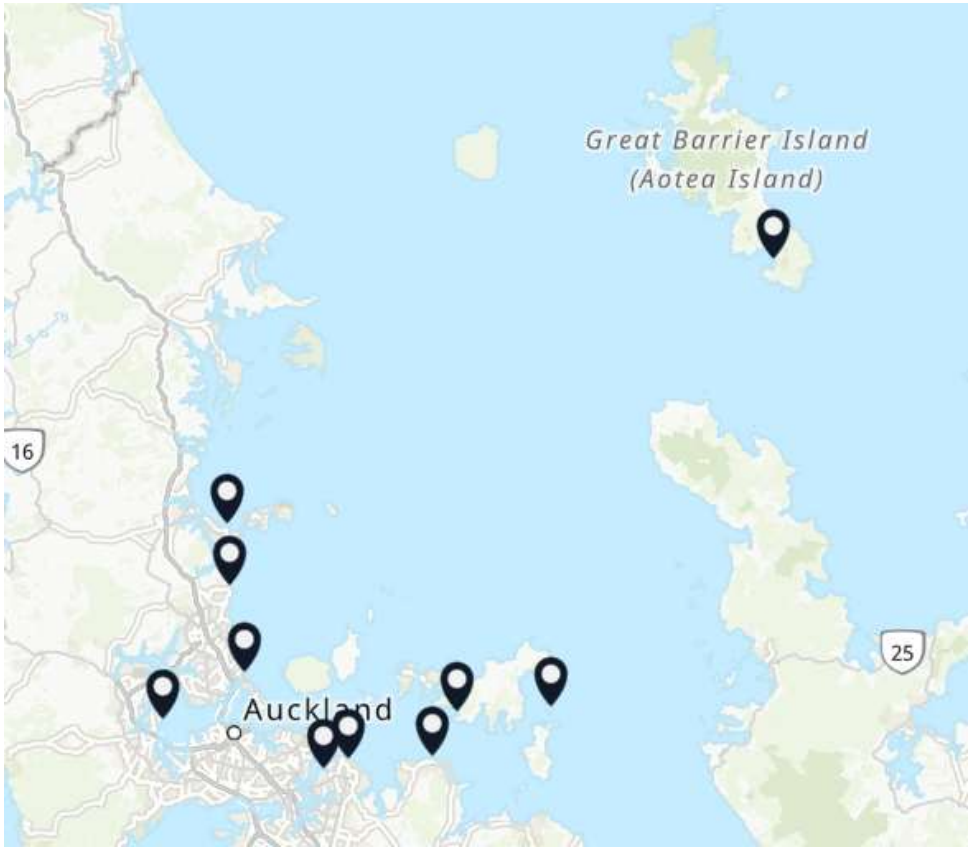


Figure 2. Sites Surveyed in 2022

Results/Discussion

Species Richness

The diversity of species recorded in 2022 was similar to that of previous years but lower than the average over the course of the project (1.3 spp/m^2; project average 1.8 spp/m^2). Plotting the data for all years the HGMP has been running indicates a gradual declining trend of the number of unique species being detected (R^2 = 0.10, figure 3). Despite 2020 deviating from this trend, it is likely that species richness was over estimated due to limited sampling effort during the COVID-19 restrictions (38 surveys total in 2020). If the peak in 2020 is ignored on this basis then the gradual decline observed in this data becomes more apparent (R^2 = 0.80). As species diversity can be used as an indicator of the health of Tīkapa Moana this decline is important to monitor for future years.

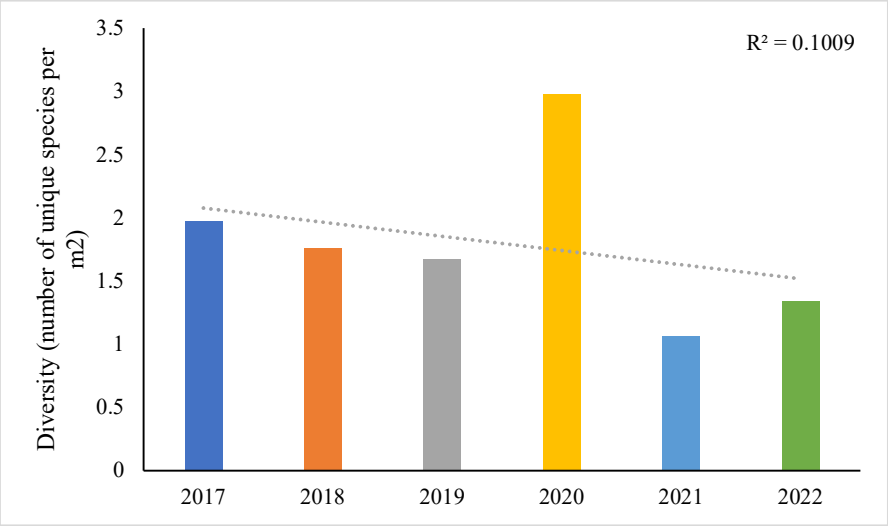


Figure 3. Diversity (number of unique species per m2) for each year of the Hauraki Gulf.

Invasive species

Both the Mediterranean Fan Worm (MFW) (*Sabella spallanzanii*) and Wakame (*Undaria pinnatifida*) have been detected in Tīkapa Moana by participants of the HGMP. Wakame has four observations with a total of 43 individuals having been detected by to HGMP surveying and the MFW has been detected a total of 17 times consisting of 145 individuals. MFW's were first discovered in New Zealand in 2008 (Biosecurity New Zealand, n.d.). This species forms dense colonies of thousands of individuals which excludes other species, both animals and producers (e.g. seaweeds), from growing (Biosecurity New Zealand, n.d.). This can impact the balance of the ecosystems they appear in by limiting food availability and changing habitat. Figure 4 shows a gradual increase from 2% of quadrats with MFW observations in 2018 to 6% in 2022. The trendline on figure 4 is influenced by the 9% value in 2019. The 2019 result was due to the repeat surveying of Waiake beach and Okura/Long Bay, whereas in 2020, 2021 and 2022 repeat surveys were not able to be undertaken due to COVID-19 restrictions. Additionally, Waiake Beach has not been surveyed as part of the HGMP since 2019 and Okura/Long bay was not surveyed in 2021 (see table 1). The inability to include these sites with known populations of MFWs can make it appear that in 2020 and 2021 MFW were decreasing in number, however, 2022's high detection rate tells us this is not the case. These findings highlight the importance of consistent and repeated monitoring as it allows for a clearer understanding of changes over time for specific locations. It is currently believed that the MFW is still not widespread and has only been detected in a few harbours around the country (Biosecurity New Zealand, n.d.). The increasing trend in the number of MFW's found by the HGMP, however, indicates potentially rapid proliferation by this species, further highlighting the importance of regular monitoring and a need for management.

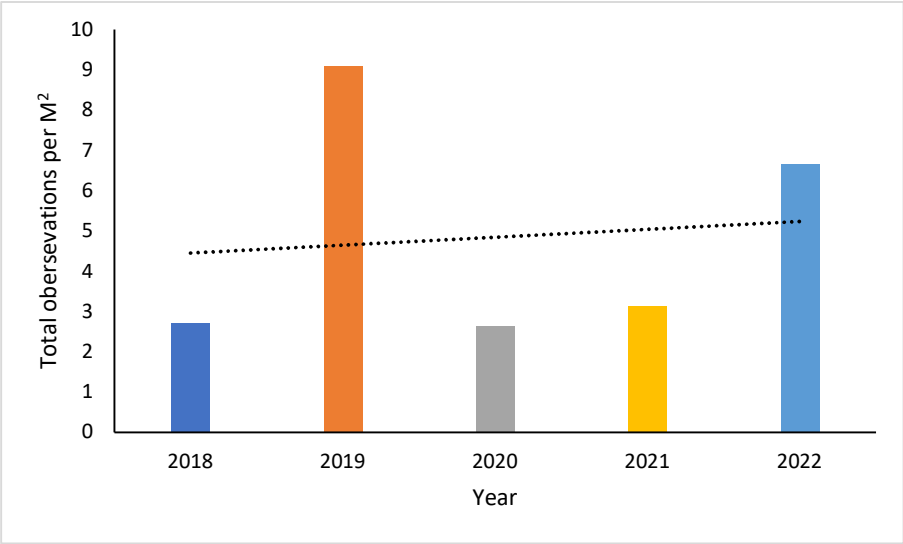


Figure 4. The number of Mediterranean Fan Worm's detected by HGMP participants each year.

Table 1. Sites at which the MRW was detected by HGMP participants

2018	Takapuna Beach	Waiake Beach	
2019	Okura/Long Bay	Waiake Beach	
2020	Okura/Long Bay		
2021	Eastern Beach	Tindall's Beach	
2022	Okur/Long Bay	Eastern Beach	Te Pene Point

Trophic Levels

The trophic level of an organism relates to its position in the food web and organisms can be separated into functional trophic levels such as producers, grazers, and predators for comparison. The prominence of one group may indicate that another trophic level is being suppressed (Ripple et al., 2016). Conversely, severe suppression of a group can be an indication that over predation is occurring. An example of this has been observed in Tīkapa Moana where commercial fishing of snapper (Pagrus auratus) and crayfish (Jasus edwardsii) has suppressed their populations. This has led to a prevalence of a lower level grazing species, kina (Evechinus chloroticus)(Morrison, 2021). Subsequently, as kina numbers exploded they overgrazed kelp beds causing the formation of urchin barrens in replacement of kelp forests. These areas are less rich in diversity, less capable of sustaining food web complexity, and considered a less healthy state of the ecosystem (Filbee-Dexter & Scheibling, 2014). By plotting the number of species which belong to each trophic level we can get an idea of the balance within an ecosystem which can reveal potential scenarios like the example above, acting as an indicator of ecosystem health (Roberta Costanza et al., n.d.). Not all suppression is caused by human impacts, however, and interactions in the food web need to be teased apart. The ability to explain a food web state with a natural process could mean that human activity is not the reason behind it. Therefore, being able to reflect on the data and what is happening at a site can inform us about whether humans can improve the health of an environment by changing our behaviour.

The number of species per trophic level at each site is shown figure 5 shows us for example, that at Takapuna producers are very prominent whilst filter feeders are not. Both producers and filter feeders have abundant resource sources but compete for space as many species of filter feeder are sessile. Sessile animals such as barnacles and oysters are permanently fixed just like seaweeds, the most common producer on the rocky shore environment. As both filter feeding animals and seaweeds require clear space that they can fix onto, the abundance of seaweed at Takapuna likely excludes filter feeders. This is mirrored in the Whakanewha and Orangihina sites where filter feeders appear to exclude seaweed diversity.

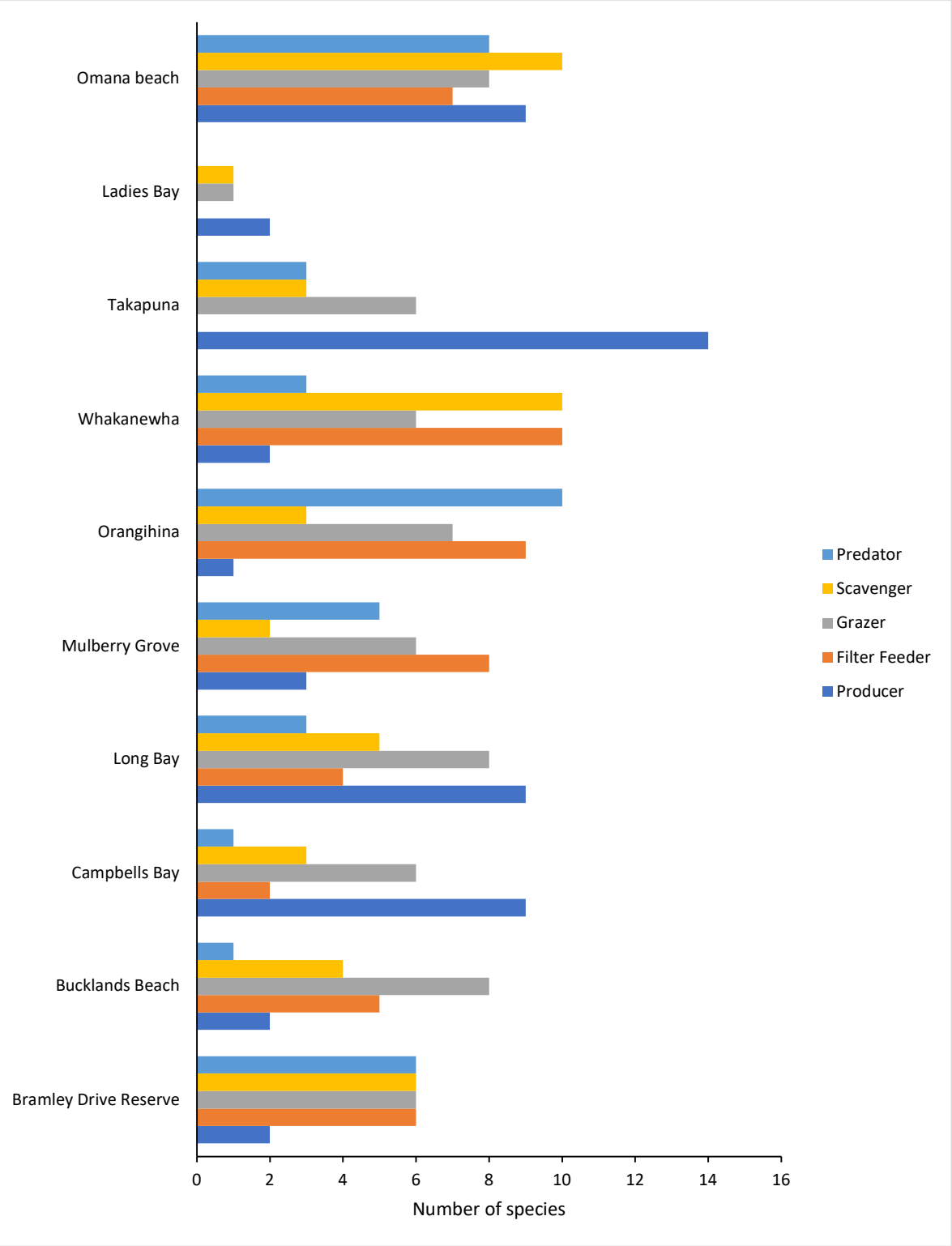


Figure 5. The number of species in each trophic level at the shores surveyed in 2022.

Data over time

An extremely useful aspect of the HGMP is the recoding of data over time for the sites which have schools that take part every year. This is extremely useful in the understanding of the variability in an environment in terms of the species richness at the site. For example, Te Atatu Intermediate has been involved in the HGMP since it began in 2017. This means that their site Orangihina/Harbourview has had data recorded ever since. An example of plots using this long-term data is shown in figure 6 below.

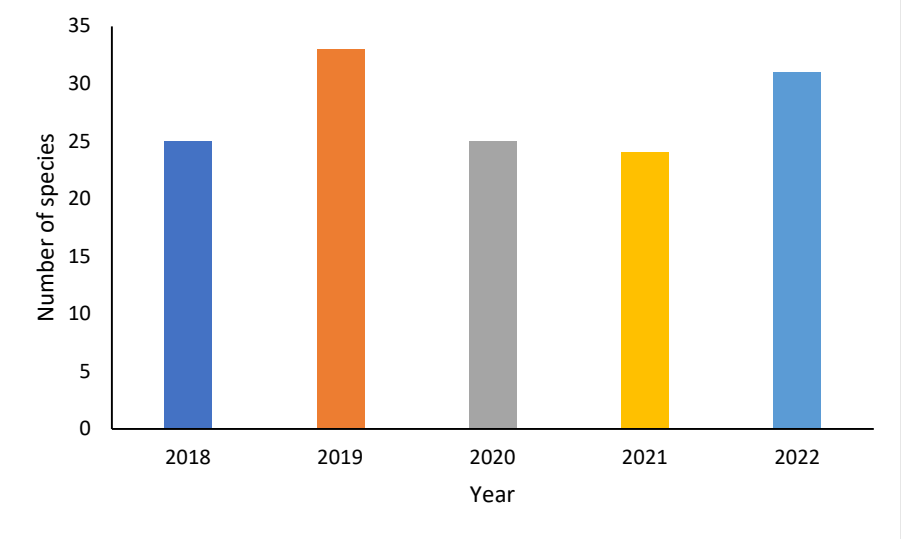


Figure 6. The number of species detected at Orangihina Reserve, Te Atatu from 2018 to present

Figure 6 shows that the number of species observed at Orangihina is variable, though the number detected in 2020 and 2021 were influenced by reduced sampling effort as a result of the COVID-19 restrictions. This data is extremely useful as it could be combined with data such as environmental data to draw conclusions about what is influencing the number species observed.

Summary

The HGMP has now surveyed 26 sites in the Hauraki Gulf Marine Park, with the involvement of 28 school and community groups. The HGMP is valuable by facilitating a connection between school students and their local environment. The involvement of schools and community groups in data collection and analysis helps to foster a sense of kaitiakitanga (guardianship) for these people as they become involved in monitoring the health of their local shore. Furthermore, this data is stored on a publicly available website (mm2.net.nz) so can be used by anyone to analyse data for a surveyed site. Additionally, this website makes it easy for citizen scientists to enter their data in a standardised way to allow the data entered across the country to be comparable.

This data provides a useful baseline as to the ongoing condition of a shore, for example the data shown in figure 6. The usefulness of this could be combined with other data to increase our understanding of the Hauraki Gulf shoreline. For future HGMP projects data collection as to bird counts as well as litter surveys could be used to gain an even clearer picture of what is happening in Tīkapa Moana.

Table 2. A summary of the groups involved and the locations since 2017

	Location	School/Community Group	2022	2021	2020	2019	2018	2017
	Bree Rocks (rocky shore)	Colvillle Harbour Care Group			X	X		X
	Bree Rocks (sandy/muddy shore)	Colvillle Harbour Care Group						X
	Bremley Drive Beach	Farm Cove School	X					
	Campbells Bay	Blake Inspire for Teachers	X	X		X		
	Coyle Park (rocky shore)	Balmoral School			X			
	Coyle Park (sandy shore)	Aless			X			
	Eastern Beach	Pakuranga College	X					
	Eastern Beach	Papatoetoe North School		X				
	Farm Cove Estuary	Sunnyhills Primary School					X	X
	Home Bay, Rotoroa Island	Rotoroa Island Eductation	X					
	Little Shoal Bay	Verran Primary School				X		
	Long Bay Regional Park (near MERC)	Long Bay Primary/Aless			X			
	Long Bay Regional Park (near MERC)	Community Event	X					
	Manly Beach	Wentworth College	X	X	X			
	Musick Point	Bucklands Beach Primary						X
	Omaha Beach	Mahurangi College		X		X		
	Orangihina Reserve/Harbour View Reserve	Te Atatu Intermediate	X	X	X	X	X	
	Pine Harbour/Green Bay	Beachlands Intermediate				X	X	
	Rosebank Domain Saltmarsh	Whau River Catchment					X	
	Shoal Bay, Aotea	Mulberry Grove School	X					
	Takapuna Beach	AGE	X		X	X	X	
	Torpedo Bay	St Leos School						X
	Tracey's Point/Walk, Maraetai	Maraetai Beach School		X			X	X
	Waiake Beach	Albany College	X					
	Waiake Beach	Long Bay Primary/Torbay Primary School				X	X	
	Waiwera Beach	Waitotara				X		
	Wenderholm Regional Park	Westlake Girls College		X				
	Westmere Park	NZAEE Regional Group	X					
	Whakanewha Regional Park	Waiheke Primary School	X	X	X		X	
Total	26	28	12	8	8	9	8	6

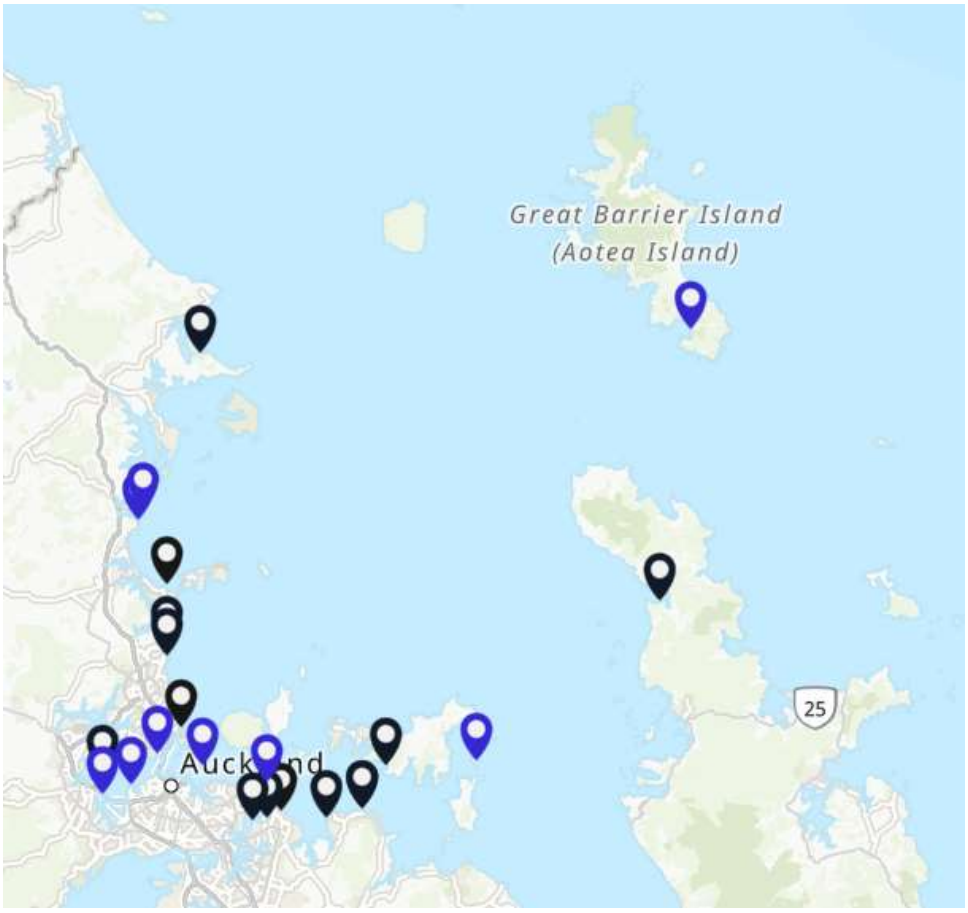


Figure 7 A map showing all sites surveyed since 2017. Sites surveyed more than once by HGMP participants (black markers) and those sites only surveyed once (blue markers)

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