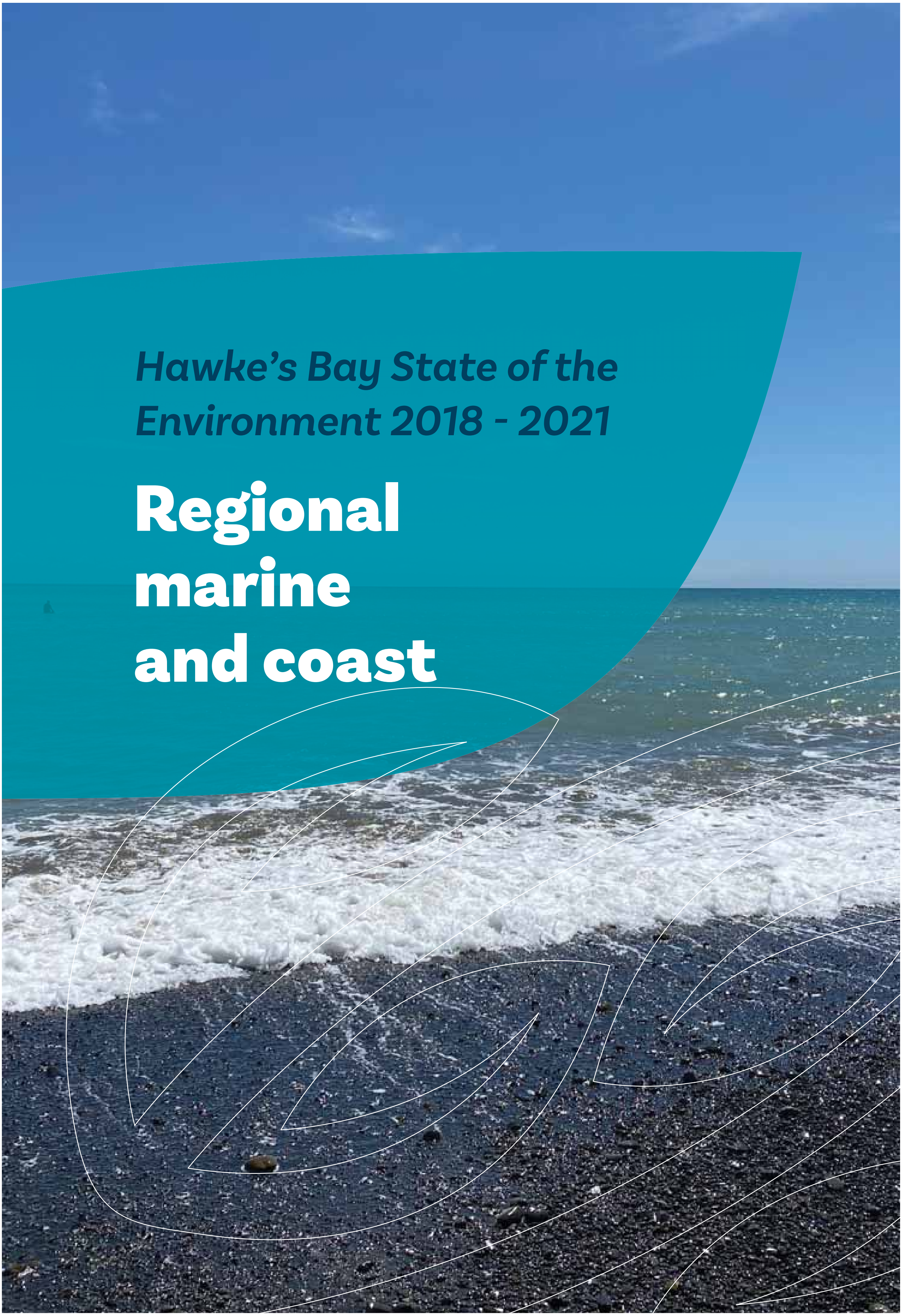
Hawke's Bay State of the Environment 2018 - 2021

Regional marine and coast



14. Marine and coastal environments

The Hawke's Bay coastline stretches 353km from Mahanga on the Mahia Peninsula in the north to Whangaehu in the south (Figure 14-1). The coastline supports a diverse range of habitats based on the local geology.

Coastal cliffs, sandy beaches, extensive dune systems, and rock platforms characterise the coastline between Cape Turnagain and Cape Kidnappers (Figure 14 2), while river mouths, estuaries, gravel beaches, and herb fields typify coastal habitats between Te Awanga and Tangoio. To the north of Tangoio, steep cliffs and associated rocky reefs extend up to the Waikari River mouth. Between the Waikari and Nūhaka Rivers, the coastline is typified by low-lying dunes and sand and gravel beaches. In the far north of the region, the Mahia Peninsula has large sandy beaches, extensive dune systems, and expansive rock platforms.

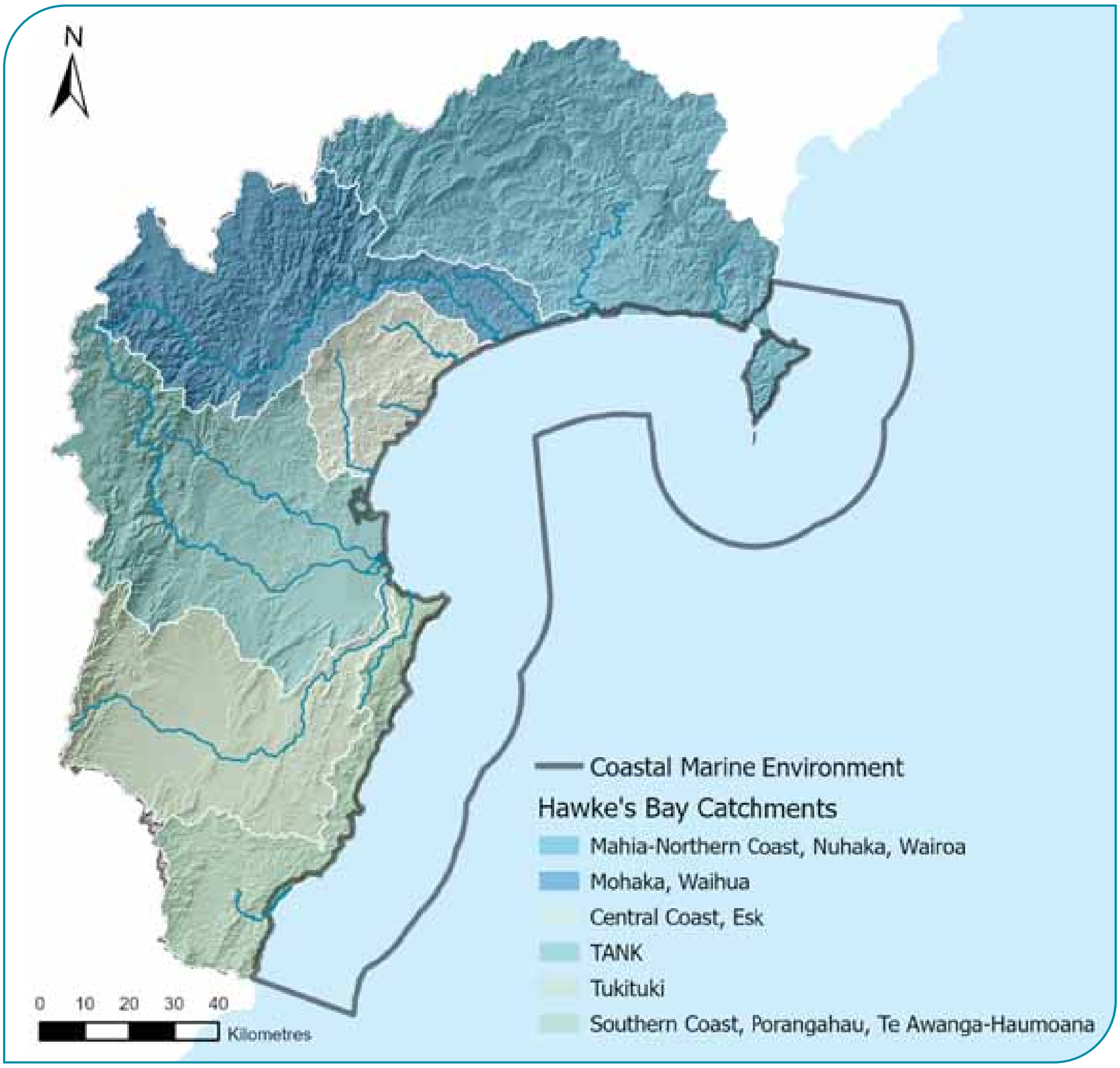


Figure 14-1. Map of Hawke's Bay Coastal Marine Environment.

Figure 14-2: Cape Kidnappers.

Figure 14-3: Aerial view of Maungawhio Lagoon in northern Hawke's Bay.

Coastal water quality

The coastal marine area is the receiving environment for all land-based activities that occur across the 1.4 million hectares of Hawke's Bay. This means they are susceptible to declines in water quality. Of the 19.7 billion m^3 of rainfall that Hawke's Bay receives each year, about 11 billion m^3 makes its way into coastal waters. Large river systems contribute to the direct transport of pollutants to the nearshore coastal environment. Monitoring coastal water quality is therefore vital to ensure that key ecological functions and services remain intact.

Levels of nitrogen and phosphorus are elevated within some Hawke's Bay estuaries. For example, nitrogen in the Tukituki Estuary is higher than in other North Island estuaries, and phosphorus is higher in the Ahuriri Estuary. These patterns are similar to those observed in the freshwater systems of Hawke's Bay, suggesting that the nutrients originated on land.

Estuaries are the first receiving point of cumulative discharges of the freshwater system. As wetlands, estuaries are areas that can process nutrients through uptake and transformation, and therefore they have the capacity to protect coastal marine waters from the effects of land-based activities. The ability of an estuary to process inputs depends on factors including estuary type and health, as well as the amount of contaminants needing to be processed.

Hawke's Bay estuaries are classified into two hydrosystem types. Shallow Intertidal Dominated Estuaries (SIDE) include Ahuriri Estuary, Maungawhio Lagoon (Figure 14-3), and Pōrangahau Estuary. Shallow, Short Residence Tidal River Estuaries (SSRTRE, or river mouths) include Wairoa, Waitangi, and Tukituki Estuaries. SIDE estuaries may be more sensitive to the addition of nutrients and contaminants than river mouth estuaries as they tend to retain water for longer. In contrast, water passes quickly through river mouth estuaries to the ocean.

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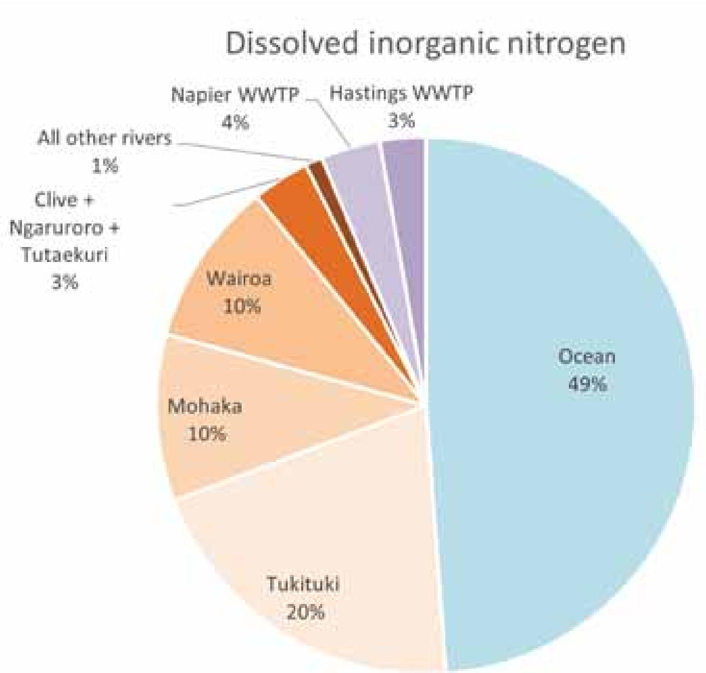
Figure 14-5. Collecting a nearshore water quality sample

Both suspended sediment concentrations and turbidity levels in Hawke's Bay estuaries are evidence of the influence of episodic events such as rainfall. For example, Pōrangahau Estuary had the highest range of suspended sediment and turbidity levels, indicating that during floods, this estuary can be subjected to some of the highest delivery of sediments in the region.

Beyond estuaries, nutrients from the freshwater system mix with ocean water, which also contains nutrients and minerals. Between Cape Kidnappers and the tip of Mahia Peninsula, the Tukituki River provides the biggest contribution (20%) of dissolved inorganic nitrogen (DIN) from the land (Figure 14-4). Other large river systems entering the Bay contribute up to 10% of DIN, and wastewater outfalls contribute 7%. Oceanic sources provide the highest proportion of DIN and dissolved reactive phosphorous (49% and 84% respectively). Rivers contribute up to 11.5% of DRP combined, and wastewater outfalls the remaining 4.5%.

Nitrogen and phosphorus concentrations in Hawke's Bay coastal waters are within the range observed in other New Zealand open coast sites. Wairoa, Awatoto, and Haumoana have elevated DIN levels compared with other sites in Hawke's Bay.



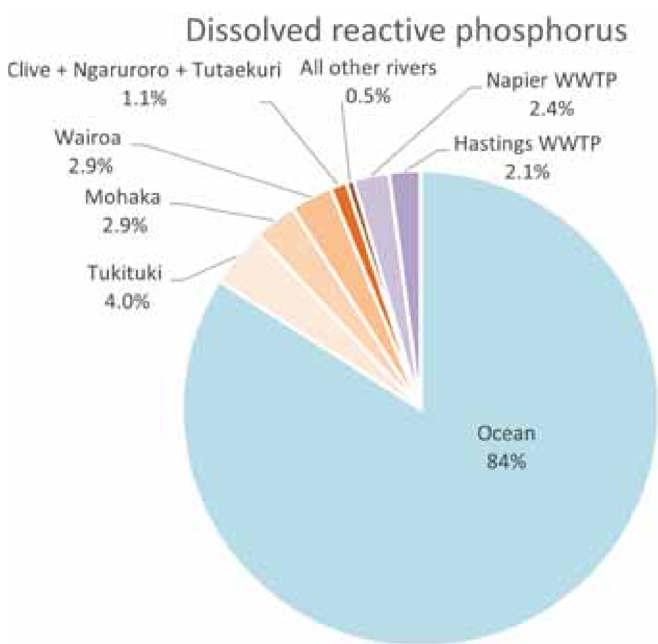


Figure 14-4. Relative contributions of dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP) in Hawke's Bay from different waterways.

Sentinel 2: 24 October 2020

Sentinel 2: 11 November 2020

Figure 14-6. Satellite imagery before and after the Napier flood event in November 2020, showing sediment discharge to the ocean.

In most marine systems, nitrogen tends to be the limiting nutrient (in other words, there is not enough nitrogen in the water to support further algal growth). Therefore, the addition of nitrogen can result in the growth of small algae called phytoplankton. A healthy system requires sufficient levels of phytoplankton to support the food chain, but if there is too much nitrogen, these levels can grow into a 'bloom'. Algal blooms can also sometimes be naturally induced through processes such as ocean upwelling. Awatoto and Haumoana have slightly elevated levels of DIN, and indications that agal growth is higher than the national average, which indicates higher productivity at this site.

Total phosphorus levels in nearshore waters have decreased at water quality monitoring sites in the region recently. This could be, in part, because of multiple dry seasons, resulting in fewer nutrients being transported to the coast.

Suspended sediment and turbidity are measurements that HBRC uses to indicate the amount of light that can penetrate the water column. These measurements can also be used to determine water clarity, as well as the amount of fine sediment that is being delivered to the marine environment from erosion or the re-suspension of seabed sediments (Figure 14-6).

Turbidity and suspended sediment levels in Hawke's Bay coastal waters are mostly similar to levels at other New Zealand coastal sites. However, turbidity in coastal waters off the Mohaka River has been above the national median since recording began in 2006, most likely due to high sediment loads from the river (1.49 million tonnes per year). Higher turbidity and suspended solids are also observed in the estuarine waters of the Mohaka.

Another measure of coastal water health is dissolved oxygen, which is the amount of oxygen within the water column available for marine organisms. Median levels of dissolved oxygen in Hawke's Bay generally indicate healthy coastal waters, however small areas around the Bay have been shown to have low dissolved oxygen levels, unusual for a Bay of this depth and exposure.

Figure 14-7. HAWQi water quality buoy.

Climate change and the coast

Climate change is a key consideration for coastal policy and management, with potential impacts from sea level rise, warming oceans, and changes in ocean pH. Monitoring data from the HBRC's coastal monitoring buoy HAWQi (Figure 14-7) has already begun to show increases in the sea surface temperature during both summer and winter (Figure 14-8).

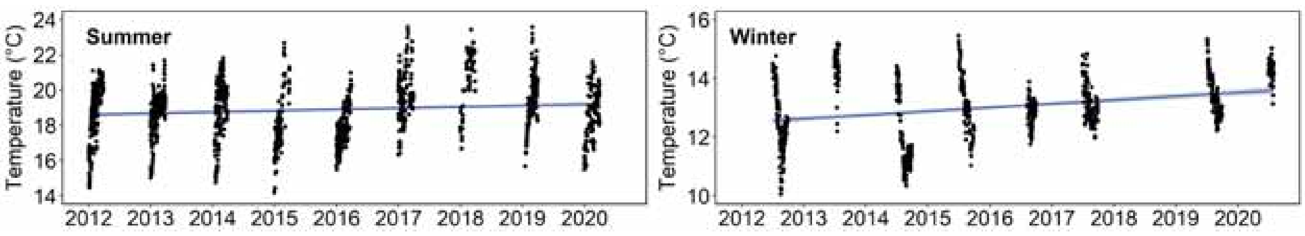


Figure 14-8. Sea surface temperature (°C) recorded during the summer and winter months from instruments on the HAWQi buoy.

A marine heatwave (MHW) is a period of five or more days with temperatures greater than the 90th percentile for the last 30 years.

Marine heatwaves have been occurring in Hawke's Bay annually since 2001. Between HAWQi's first deployment in 2012 and 2020, there have been 33 marine heatwaves (Table 14-1). A severe marine heat wave in the summer of 2017-2018 impacted coastal ecosystems both nationally and locally (see Ecosystem health section).

	MHW Events	MHW Days
2012	1	5
2013	4	64
2014	4	62
2015	3	43
2016	6	184
2017	5	68
2018	5	136
2019	3	107
2020	2	37

Table 14-1. Marine heatwave (MHW) events between 2012-2020 and the total number of days per year in those events.

Figure 14-9. Rangaiika sand dunes near Hastings, is one of the best dune systems on the east coast.

Dune condition index

Sand dunes are an important and constantly changing part of our coastal environment. Hawke's Bay is home to some of the most significant dune systems on the east coast of the North Island (Figure 14-9). Dunes make up 22% of the Hawke's Bay coastal/terrestrial margin and protect the coastline from flooding and inundation. Dune vegetation forms habitat and food for a variety of native birds, insects, and reptiles.

Native dune vegetation has suffered from animal grazing and trampling and from competition with introduced plant species. Other native dune plants and animals are threatened from habitat loss and predation.

The dune condition index is a technique that uses the rapid assessment of a dune system to measure its ecological integrity. The dune system is given a score between 1 and 5 for each type of pressure (eg, predators, invasive plants, and vehicle access) and for various health or 'state' variables (eg, indigenous vegetation dominance and buffering). The scores are totalled and compared against a possible maximum score of 65, with a higher score indicating a better condition.

Table 14-2 shows the dune condition index for Waimarama dunes. These dunes suffer from predators and other pressures, and the system has the lowest condition of the three dune systems assessed in Hawke's Bay to date (including Rangaiika and Opoutama dunes).

		Dune System
		Waimarama
Pressures	Deer, cattle, pigs, sheep & goats	0
	Rabbits, Hares & Possums	0
	Predators	0
	Dogs	0
	Problem Plants	0
	People walking on the dunes	2
	People driving on the dunes	1
	Mining	5
State	Indigenous cover dominance	1
	Indigenous animal dominance	5
	Unnatural vegetation disturbance	4
	Buffering - indigenous land cover	0
	Buffering - indigenous cover dominance	1
	Total	**19**
	Percentage of maximum score	**29%**

Table 14-2. The dune condition index for Waimarama dune system. The total score is compared to a possible maximum score of 65, with higher scores indicating better health.

Litter Intelligence

Globally, plastic has been found throughout coastal and marine environments, even in remote locations like the deep sea. In Hawke's Bay, plastic particles have been found in core samples in both estuarine and sandy beach environments.

Across 35 surveys since 2019, the Litter Intelligence programme [1] has found that plastic is the most common type of litter in the coastal environment, representing 76% of all rubbish items collected (Figure 14-10). Rubber, wood, glass, and ceramic were the heaviest types of rubbish collected, with wood contributing 59% of the total weight of rubbish collected.

Ahuriri Estuary had the highest litter density of the sites in the region, and Waitangi Estuary had the second highest (Figure 14-11). Both estuaries are important habitats for Hawke's Bay's coastal indigenous bird populations (see Biodiversity in Hawke's Bay section).

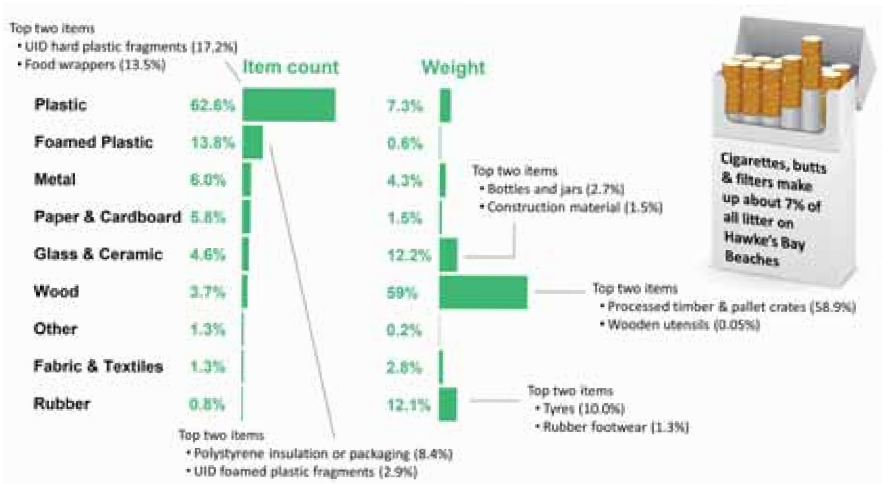


Figure 14-10. Summary of litter items found in Hawke's Bay Litter Intelligence surveys.

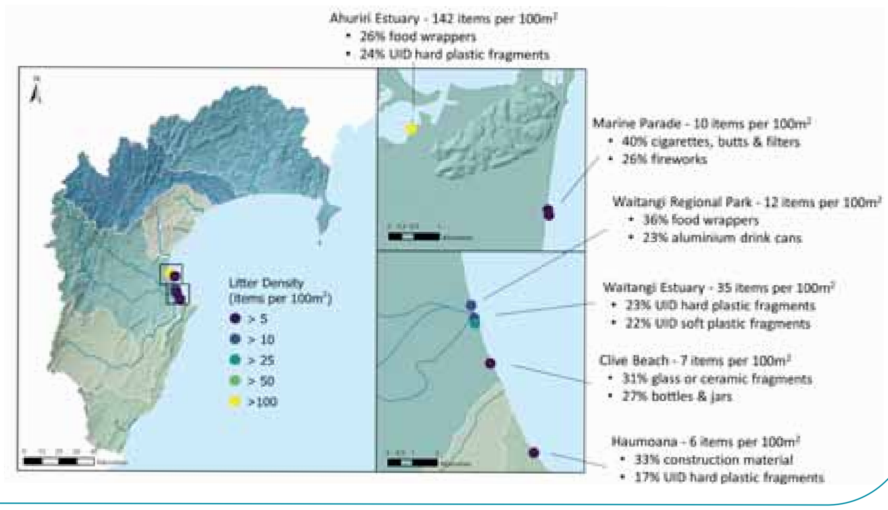


Figure 14-11. Litter density and top litter items at Litter Intelligence survey sites.

[1] The Litter Intelligence programme is an ongoing national citizen science initiative that monitors litter through standardised surveys around New Zealand. It is run by Sustainable Coastlines, established in May 2018 with funding from Ministry for the Environment's Waste Minimisation Fund.

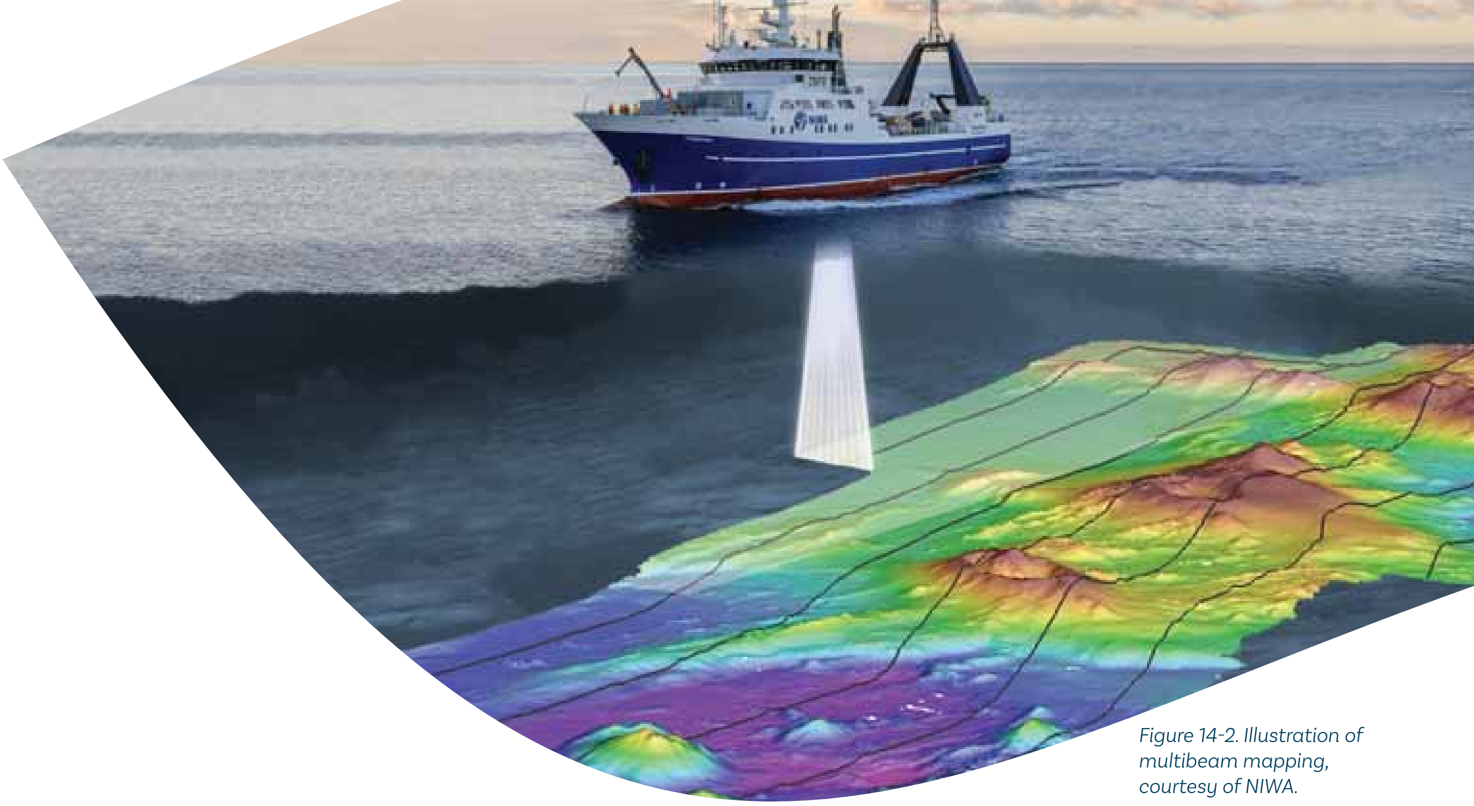


Figure 14-2. Illustration of multibeam mapping, courtesy of NIWA.

Exploring the undersea world

Our coastal and subtidal habitats and ecosystems are vulnerable to the effects of sediment and other contaminants that make their way there from our rivers. Sediments can smother animals and plants and change the structure of the seafloor.

How can we see whether our activities on the land are influencing our coastal waters? Multibeam echo sounder surveys have given us the ability to 'see' through the water and map the seafloor (Figure 14-12). Gravels, sand, mud, and reefs are all visible and can help us target areas with high biodiversity to ensure that we keep them healthy.

Over the past four years, HBRC, NIWA, and Fisheries New Zealand have collaborated to map just under 300km^2 of the Hawke's Bay coastal marine area in the Wairoa Hard, Clive Hard, Cape Kidnappers, Mahia Peninsula, and Tangoio areas (Figure 14-13). This is approximately 4% of the Hawke's Bay subtidal area.

One of the mapped areas, the Wairoa Hard, is an area of course substrate that extends between the Moeangiangi and Mohaka River mouths. Valued for its fish nursery habitat, the 'Hard' was closed to net fishing in 1986, but meanwhile other marine stressors such as sedimentation were thought to have changed the composition of the hard substrate that helped support local species richness.

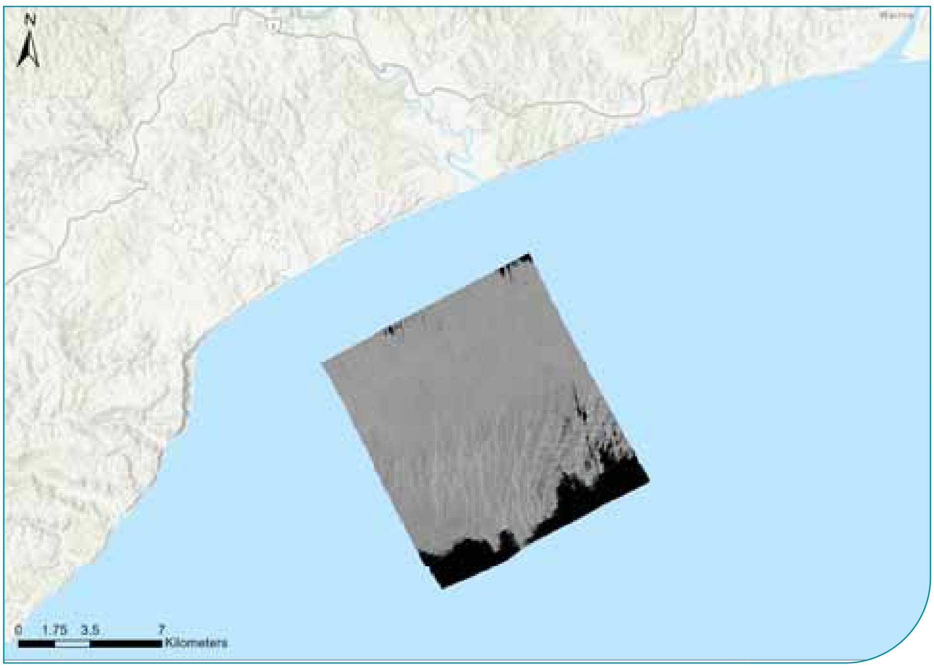


Figure 14-13. Backscatter images from the Multibeam surveys of Wairoa Hard. Light grey indicates areas of high reflectivity and hard substrate (eg, rocks, cobbles, and gravels). Dark grey areas have low reflectivity and soft substrate.

In 2018, HBRC, NIWA, and the Ministry for Primary Industries (MPI) began the most comprehensive survey of the Hard since the 1986 closure. Mapping two-thirds of the Hard, the work showed that much of the Hard was still composed of large areas of hard substrate. Future work aims to complete the mapping to determine whether sediments from the Mohaka and Wairoa Rivers may be influencing the north-eastern edge of the Hard. HBRC also used an underwater video to look at the animals and plants that use the benthic area of the Hard such as blue cod, trevally, leatherjackets, and various species of sponges and kelp (Figure 14-14).

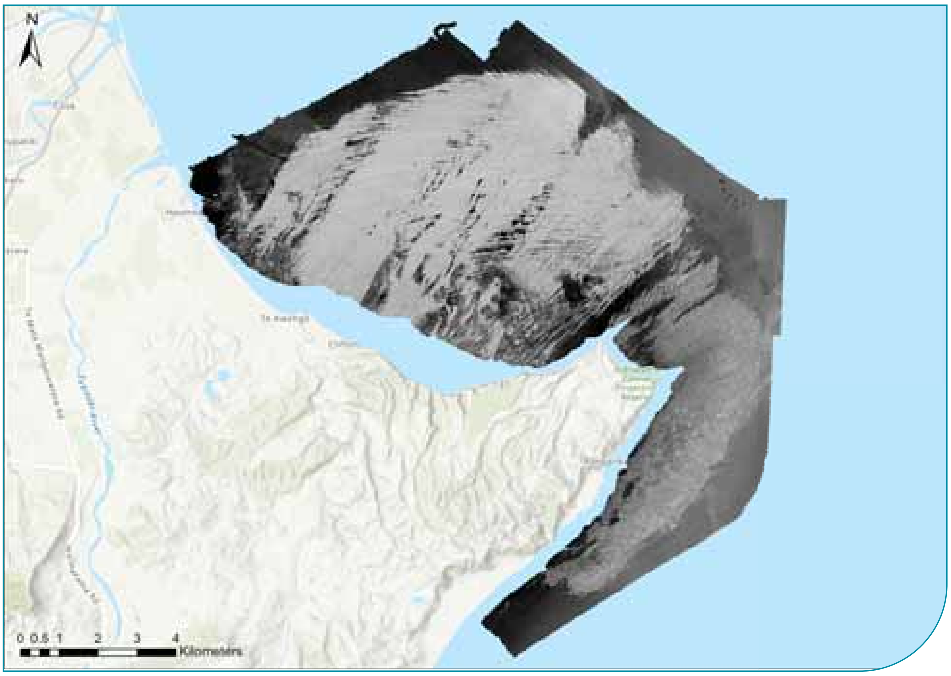


Figure 14-13. Backscatter images from the Multibeam surveys of Clive Hard. Light grey indicates areas of high reflectivity and hard substrate (eg, rocks, cobbles, and gravels). Dark grey areas have low reflectivity and soft substrate.

Figure 14 14. Algae and blue cod on the Wairoa Hard.

Figure 14-15. Aerial view of the Tukituki Estuary.

Our estuaries

As the interface between land and sea, intertidal, estuarine, and fringing coastal habitats are distinctive and dynamic environments. In New Zealand, estuaries are recognised as the most at-risk coastal environments, as they are the depositional endpoint for contaminants such as nutrients, sediments, trace metals, and pesticides.

The physical structure of the estuary, and the animals and plants that live there, all play important roles in keeping our environment healthy and clean. Their ecosystem services help to regulate our atmosphere, cycle nutrients, and produce much of the basis of the food chain. The small worms that live in the estuary sediment provide a source of food for birds and fish and also keep the sediment clean and full of oxygen. Not only are cockles nice to eat, but they filter several litres of water over their gills per day, helping to clean the water and reduce the risk of phytoplankton blooms. Microbes living on and in the sediment help to cycle nutrients and maintain balance of the nutrient cycle (Figure 14-16).

However, while the role that each animal plays is important in keeping the estuarine ecosystem healthy, we need several species doing each job so that if something happens to one species, that job is still done. This is called resilience, which is the ability of the environment to recover if the system is disrupted.

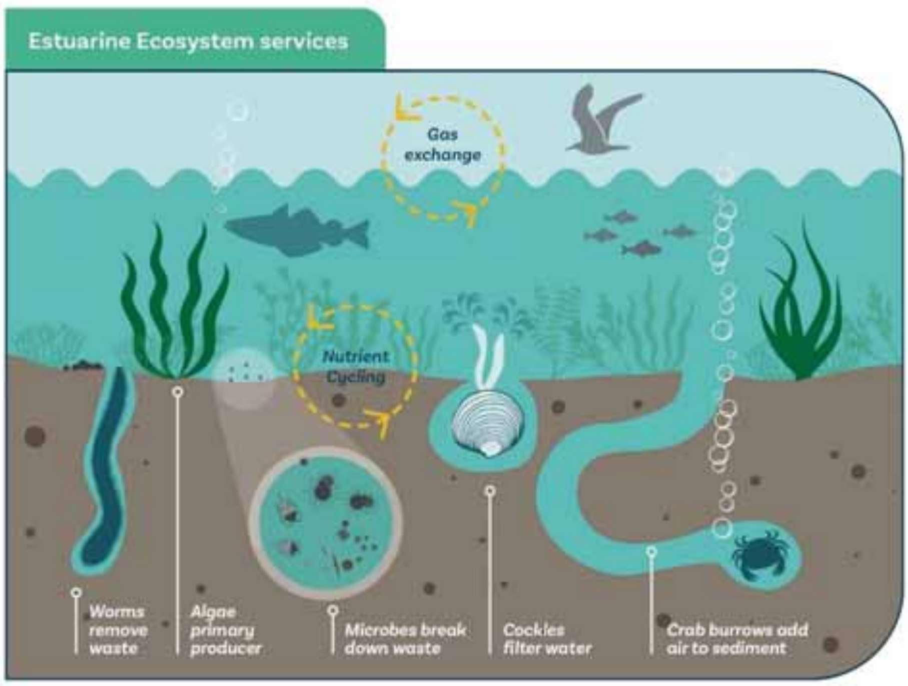


Figure 14-16. Types of ecosystem services provided by estuarine animals and plants.

The size of sediment particles found at an estuary site is a key driver of the types of animals that can live there. Healthy estuarine systems tend to be sandy, with a transition from fine sands in the upper reaches to coarse sand close to the mouth. Fine mud (particles that are less than 0.063mm) tends to be indicative of inputs from land and can occur in the upper reaches where freshwater enters the estuary. In Hawke's Bay, the input of fine sediments remains a key stressor for estuaries.

Figure 14-17 shows the median levels of fine mud measured in estuarine sediments in the region over the last five years. Estuary systems with less than 10% mud content (below the green line) generally have conditions suitable for even some of the most sensitive species, while estuary sites with 25-30% mud (amber line) generally have communities with higher diversity and abundance than sites with >25-30% mud.

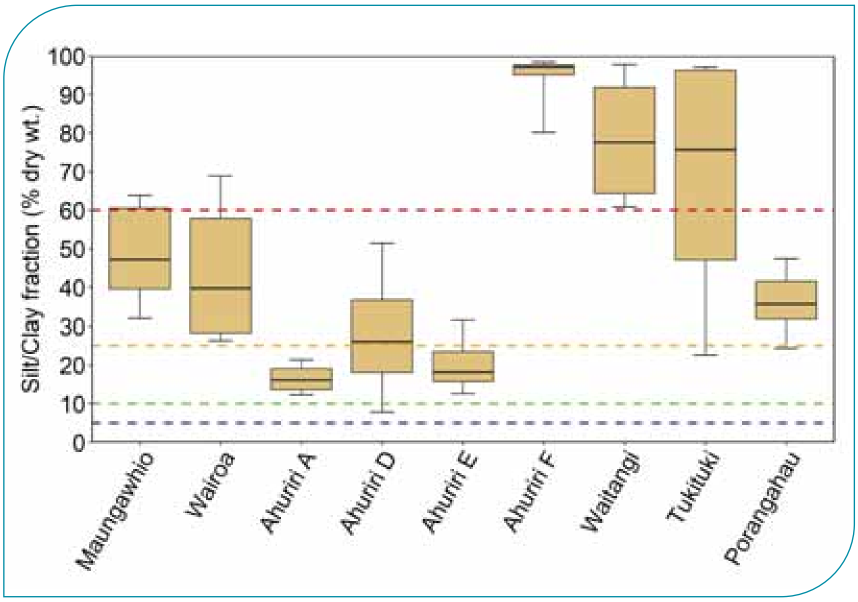


Figure 14-17. Median levels of fine mud (<0.063mm) in estuarine sediments between 2016-2021. Blue dash line = 5% mud content, green dash line = 10% mud, amber line = 25% mud, red line = 60% mud

Healthy estuarine systems tend to be sandy, with a transition from fine sands in the upper reaches to coarse sand close to the mouth.

Several of our estuaries are either moderately or severely sediment stressed (mud above 25% or 60% respectively), and in these areas, sensitive animals cannot survive. By monitoring the animals living in estuarine sediments over time, we can detect if there is a shift in community structure that may indicate land-based stressors like sediment, nutrients, or pollutants.

Figure 14-18 shows how the species assemblage living in the sediments at each of our monitored sites has changed over time. Points in the graph (macroinvertebrate communities) that are close together are more similar to one another, while points farther apart are different. It appears that macroinvertebrate communities at most sites have been relatively stable over time. However, our assessments show that the animals living in the sediments have low functional resilience (only 1-2 species doing a job), which is among the lowest observed nationally.

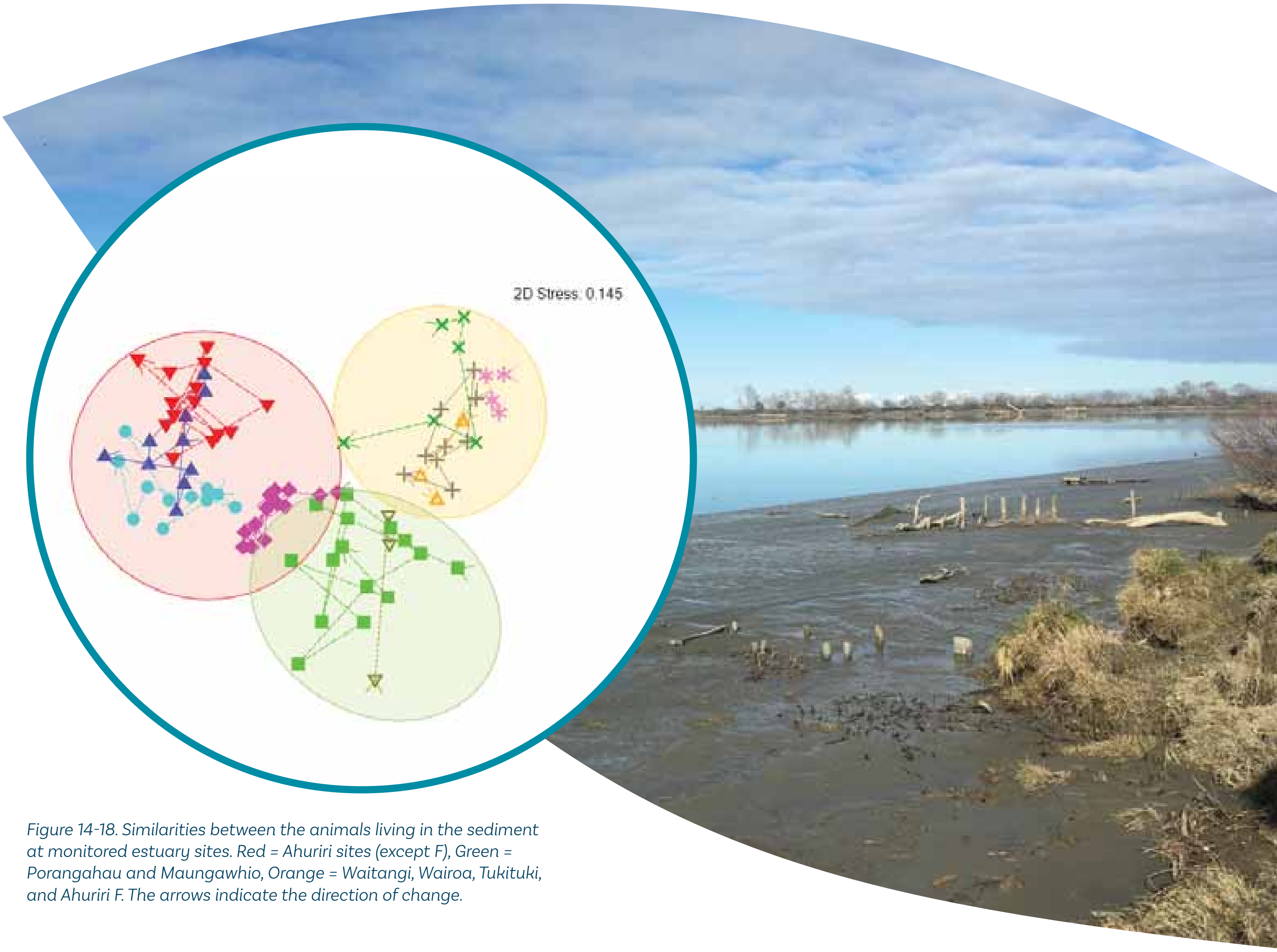


Figure 14-18. Similarities between the animals living in the sediment at monitored estuary sites. Red = Ahuriri sites (except F), Green = Porangahau and Maungawhio, Orange = Waitangi, Wairoa, Tukituki, and Ahuriri F. The arrows indicate the direction of change.

A low functional resilience means that if a change to the environment affects one species, no other species are able to take over that ecosystem service, which creates a high risk that ecosystem functioning will collapse. Recent modelling supports this assessment of Hawke's Bay estuaries, although it also indicates that reductions in suspended sediment concentrations are likely to result in improved estuarine condition. For the Ahuriri and Waitangi Estuaries, these improvements will be even greater if nitrogen inputs are also reduced.

Although reductions in sediments appear to have the greatest impact on estuarine health, they need to be considered in combination with nutrient reductions. Currently, the moderate to high levels of suspended sediments in the water column reduce the light availability to plants. If sediment levels are reduced without accompanying reductions in nutrients, there is an increased risk of nuisance macroalgae and phytoplankton growth. This highlights the need to look at the whole ecosystem to improve health outcomes.

Our swimming spots

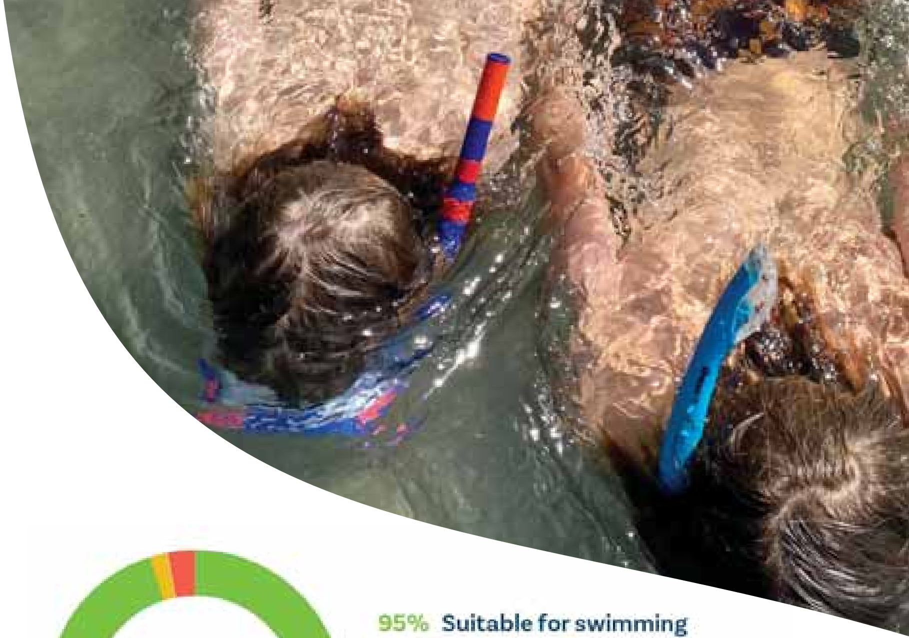
Hawke's Bay's coastal waters, lakes, and rivers provide for a range of recreational activities, improving our physical health, enhancing wellbeing, and connecting us with the natural environment. How people choose where and how to use recreational waterways varies and may depend on factors such as cleanliness, access, proximity, and water quality.

In general, Hawke's Bay beaches tend to have excellent water quality and are suitable for swimming most, if not all, of the time (Figure 14 19). Rivers also tend to have water suitable for swimming, although these sites are more vulnerable to impacts from heavy rain. Over the summer, Hawke's Bay often experiences tropical weather systems that bring periods of wet weather and elevated levels of bacteria in waterways. This tends to clear after approximately 2-3 days.

Hawke's Bay's high energy coastline means that many families seek out estuarine and lagoon areas for safer swimming. Because these areas are often slow flowing and warm, they provide an ideal habitat for bacteria, and therefore they tend to have fewer days that are considered suitable for swimming. Flocks of birds can also contribute to faecal material in lagoon areas.

Of Hawke's Bay's open coastal beaches, Blackhead and Pōrangahau have the highest water quality, suitable for swimming at all monitored times over the last five years. Port Sandy Beach in Ahuriri and Te Awanga Beach had the lowest level of swimmable days at 93%. Stormwater runoff at Port Sandy and river influences at Te Awanga may impact water quality at these sites.

While the Ngaruroro River had the highest recreational water quality (98% swimmable over the past five years), the northern rivers of Wairoa and Nūhaka had consistently poor recreational water quality and were unsuitable for swimming over 20% of the time. In other words, these rivers were considered unsuitable for swimming almost a day and a half each week on average. For the Wairoa River, this poor quality along with deteriorating water quality over time indicates that further work across the catchment to remove sources of contamination is needed to improve recreational water quality.



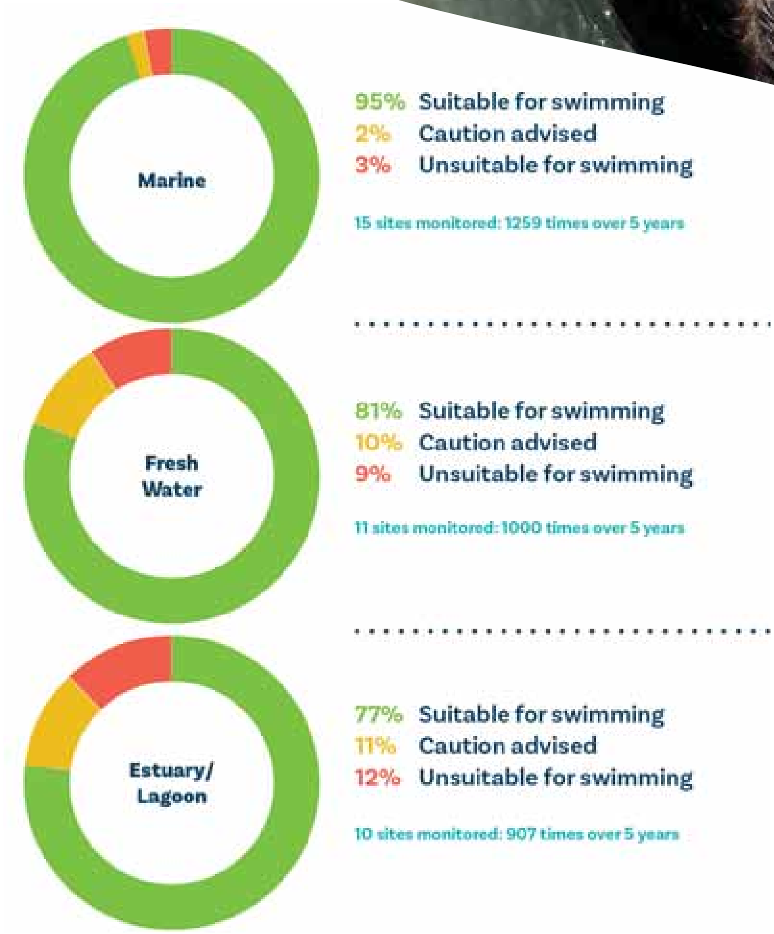


Figure 14-19. Proportion of the time over summer that marine, freshwater, and estuarine/lagoon sites in Hawke's Bay were suitable for swimming between 2016-2021.

A similar pattern was observed for Waipatiki Lagoon, Kairākau Lagoon and Pōrangahau Estuary, all of which have poor recreational water quality (20%, 18%, and 14% unsuitable for swimming respectively) and deteriorating water quality over time.

Our marine and coastal areas support a diverse range of habitats and species and provide many services valuable to us and important to our health and well-being. These environments can be compromised, particularly by increased sediment coming off the land. Targeted erosion control, fencing and planting will all assist in improving the health of these systems.