COASTAL MONITORING

Main Points

- Bacteriological water quality was monitored at a selection of popular marine bathing areas during summer 2001/2002 to assess suitability for recreational bathing. Seventy-nine percent of sites were considered safe for bathing, 18% potentially unsafe and 3% high likely to be unsafe.
- The study of sand resources and associated coastal processes of the Kaipara Harbour (the 'Kaipara Sand Study') was nearing completion.
- The national estuarine monitoring protocol being developed to assess the state of 'health' of estuarine ecosystems was nearing completion. The next stage of implementation involves a preliminary assessment of estuary condition for prioritising estuaries for monitoring.
- The Coastal Hazard review for Far North sites was continued. Fieldwork has been completed for most selected areas. Recommendations have been made for the Omapere coastal hazard zone.

Annual Plan Performance Targets

To continue to develop and implement a prioritised state of the environment-monitoring programme based on the Regional Policy Statement and Regional Plans by:

- **Carrying out sampling and reporting on marine bathing water quality.**
- **Supporting and contributing to the development and implementation of coastal hazard management strategies by the collection and provision of coastal hazard and processes information and advice to the communities of affected areas.**
- **Contributing funding to and participating in the development of a national estuary monitoring protocol.**
- **Contributing funding to and participating in the working party for a study of the sand resources, and associated coastal processes, of the Kaipara harbour, in conjunction with the Auckland Regional Council and sand mining industry.**

Coastal Water Quality

Marine Bathing Water Quality

Northland's coastal waters are amongst the cleanest in the world, but from time to time these waters may become contaminated with microbial organisms (pathogens) that can make people sick.

Water quality testing tells us that the health risk for contact recreation in most of Northland's nearshore coastal waters appears to be very low. However, following heavy rainfall the health risk tends to increase and may be present for several days following rainfall. At open coast locations the health risk is less than that at estuarine or harbour locations, which may concentrate contaminants under conditions of limited tidal flushing. Contamination of nearshore coastal waters may result from various sources including sewage, septic tank seepage, sewage discharges from boats, contaminated stormwater and diffuse run-off from the land.

Summer 2000/2001

To assess Northland's nearshore coastal water quality, in terms of microbial risk to human health, the Northland Regional Council monitored levels of indicator bacteria (enterococci and faecal coliform bacteria) in water at popular coastal swimming locations during the peak 2000/2001 bathing season (between December to January).

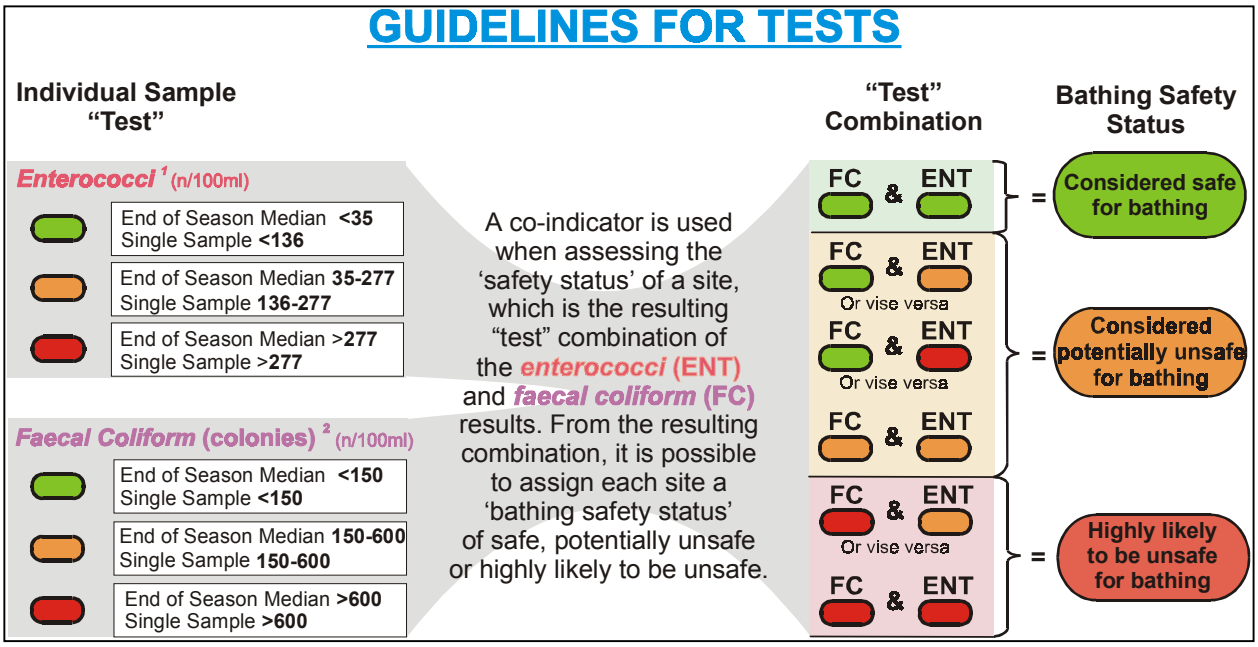
The results from this monitoring enable an assessment to be made as to the suitability of bathing areas for contact recreation based on the levels of indicator bacteria recorded in the water. These are indicative of pathogen levels and therefore the potential risk of illness to the bather.

Several sites were monitored, generally on at least five separate occasions, at each of the following locations in 2001/02:

- Mangawhai Harbour
- Whangarei Harbour (mid and lower harbour)
- Pataua estuary
- Ngunguru estuary
- Matapouri
- Whananaki estuary
- Coopers Beach and Taipa
- Bay of Islands
- Tinopai, Pahi and Whakapirau – Kaipara Harbour

Guidelines for Marine Bathing Water Quality in Northland

The guidelines below show how the results of the water quality tests are combined to determine the 'bathing safety status' at each site. Refer to these guidelines for an explanation of the 'bathing safety status' assigned to each site in the following site descriptions and maps.



1 Enterococci levels have been adapted from MfE and Ministry of Health 2002, Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas. Levels are based on not fewer than 5 samples within any 30 day period.

2 Faecal Coliform levels are taken from the Northland Regional Council *Revised Proposed Regional Coastal Plan*, Contact Recreation Standard CB. Levels are based on not fewer than 5 samples within any 30 day period, where the median is <150 $100ml^{-1}$ and an 80%ile of <600 $100ml^{-1}$.

NB: The Northland Regional Council believe that both Faecal Coliform and Enterococci are important indicators of potential water quality, and that they should be used together. A high level of both enterococci and faecal coliforms occurring at one site is considered more indicative of a significant water quality issue than one or other only being elevated.

Summary Results

Figure 6.1 summarises the 2001/02 water quality results as compared to the Northland water quality guidelines.

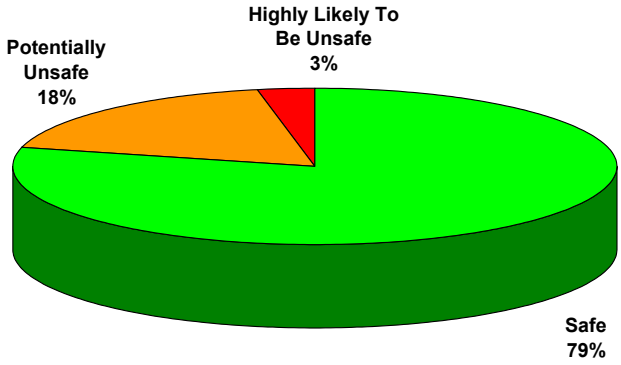


Figure 6.1: Safety status of all sites based on the end of season median

A brief description of the water quality monitoring results for 2001/02 is given in the following sections. It is important to note that this description, and the accompanying diagrams, relates only to the end of season median result unless stated otherwise.

Mangawhai Harbour

Several sites in the vicinity of the inlet were considered potentially unsafe for bathing. It is not possible to directly attribute a single source of contamination to these sites, although possible sources include runoff from a nearby stream, possible septic tank seepage and contaminated stormwater. However, as only enterococci were elevated at these sites, it is not possible to distinguish if the elevated enterococci levels are a result of faecal contamination or from naturally occurring enterococci associated with plant and organic material.

Ngunguru Estuary

All sites within the Ngunguru estuary were considered either potentially unsafe or highly likely to be unsafe for bathing. Only two sites were considered highly likely to be unsafe for bathing, as they displayed both elevated counts of enterococci and faecal coliform bacteria, which indicates a high likelihood of faecal contamination. At the sites considered potentially unsafe for bathing, it is unclear if the elevated enterococci levels are a result of faecal contamination or from naturally occurring enterococci associated with plant and organic material. A possibility exists that the high mangrove density within the estuary may have contributed to the elevated enterococci bacteria levels, as naturally occurring enterococci are known to proliferate in organic matter contained within mangrove forests.

Whananaki

The Whananaki Inlet shoreline was included in the programme for the first time in summer 2001/02. Sampling was only carried out on one occasion. Results from this showed only low levels of enterococci and faecal coliform bacteria at all sites. Hence, all sites were considered safe for bathing.

Taipa and Coopers Beach

All the sites at Taipa and Coopers Beach were considered safe for bathing.

Whangarei Harbour (Eastern settlements)

The settlements of the eastern Whangarei Harbour were only sampled on one occasion during the bathing season. All sites were considered safe for bathing.

Pataua

All the Pataua sites were considered safe for bathing.

Tinopai

One site at Tinopai was considered potentially unsafe for bathing. This site is a swimming hole upstream from the marina. All other sites along the Tinopai foreshore were considered safe for bathing.

Pahi and Whakapirau

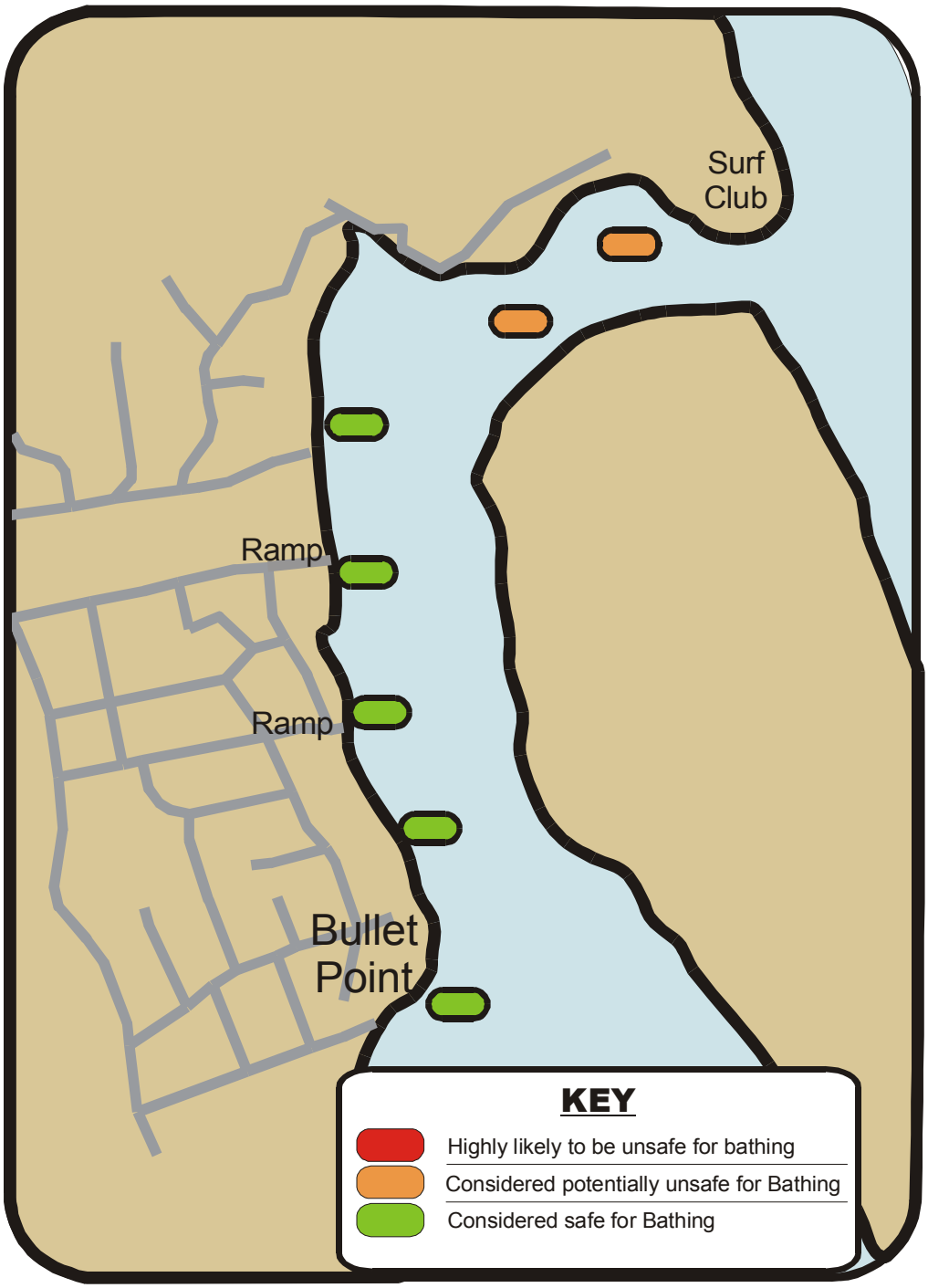
Sites at Pahi and Whakapirau were generally considered safe for bathing. One site near the Pahi River was considered potentially unsafe due to elevated enterococci.

Matapouri Beach and Estuary

Three sites at Matapouri were considered potentially unsafe for bathing. Two of these sites are within the estuary and one on the beach. It is possible that the elevated enterococci results may be the result of naturally occurring enterococci bacteria and not a result of faecal contamination, as only enterococci bacteria were elevated. This is similar to other areas within Northland (i.e. Mangawhai and Ngunguru) and may be an effect of the mangrove forest within the estuary which can contribute to elevated enterococci bacteria levels (refer Section Xx).

Bay of Islands (Opua, Paihia, Russell)

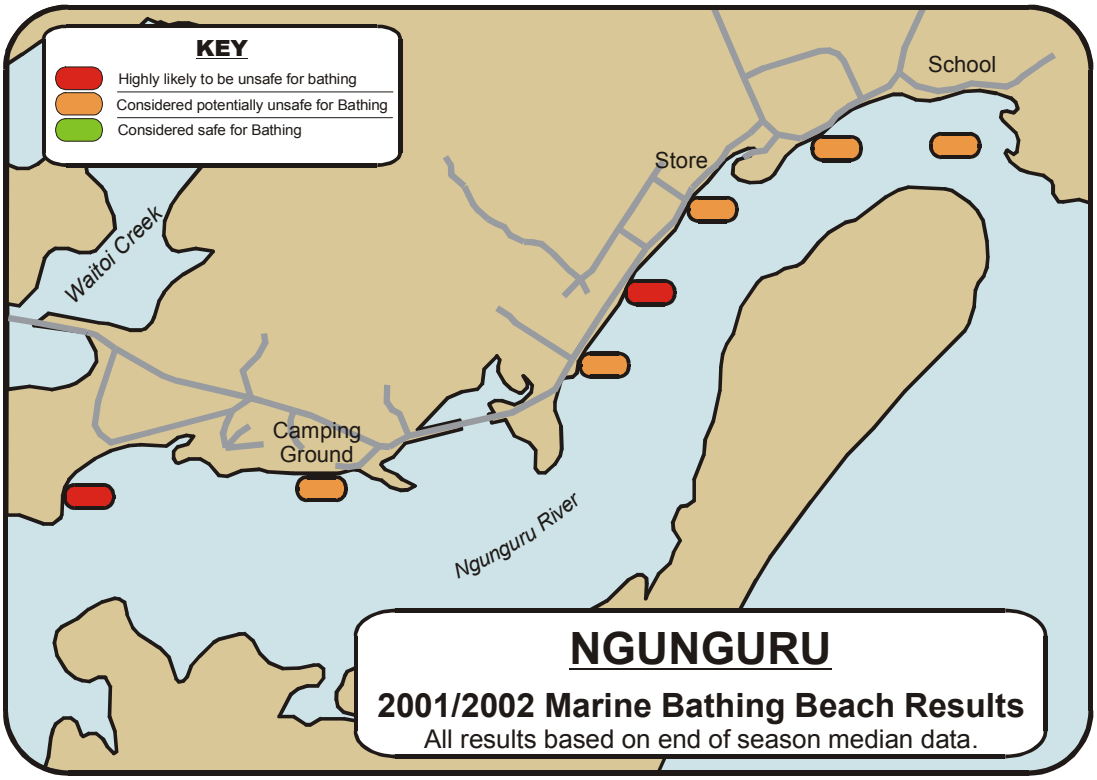
All sites sampled were considered safe for bathing.

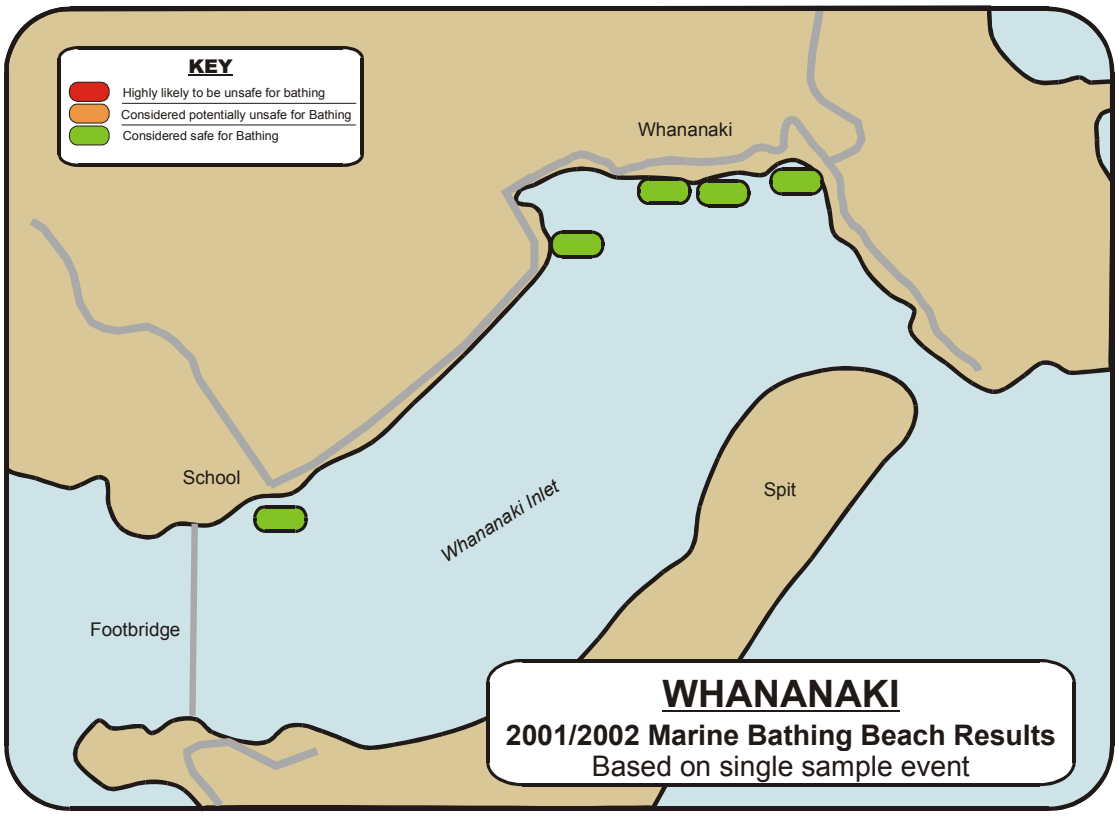


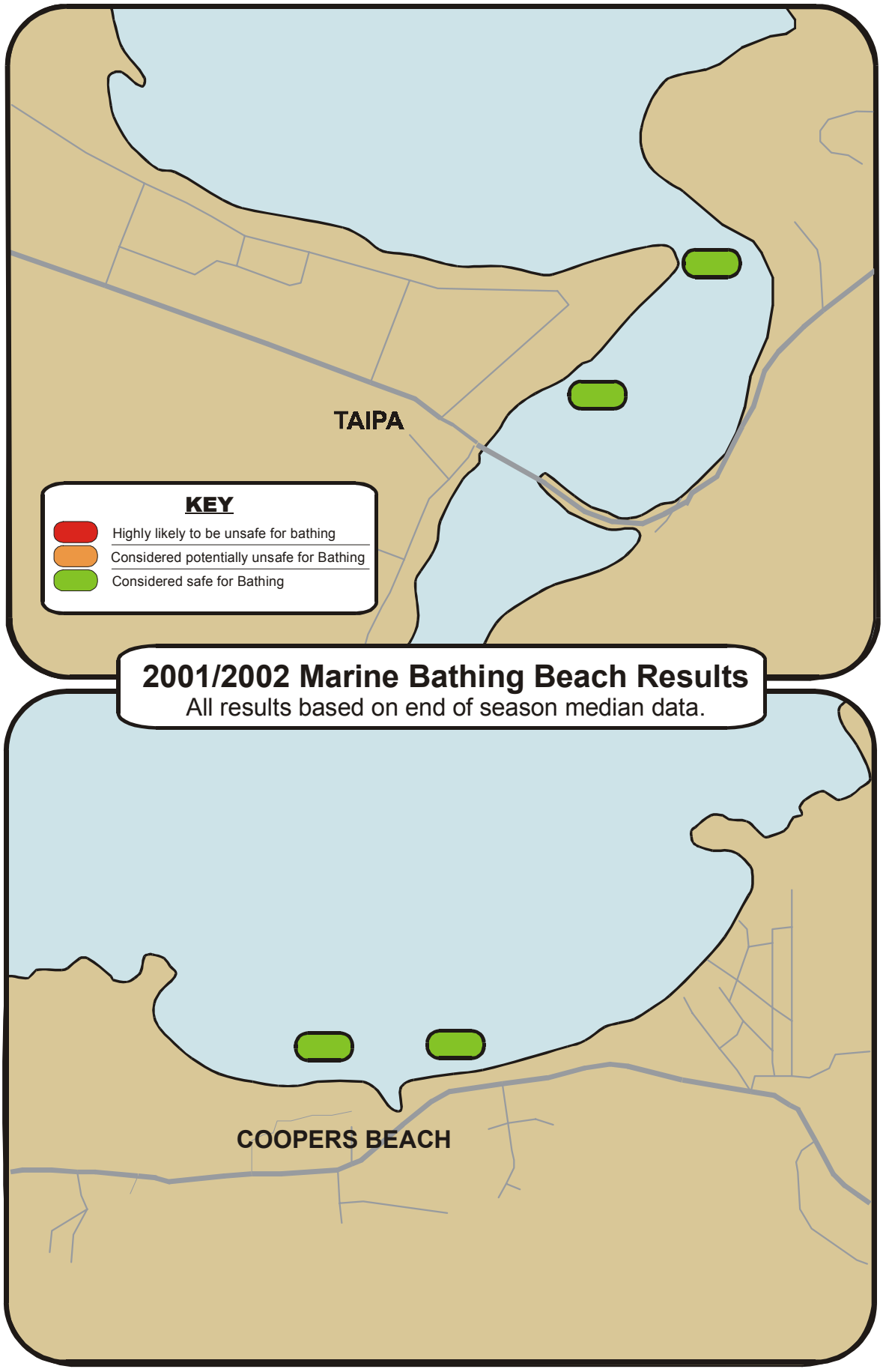
MANGAWHAI

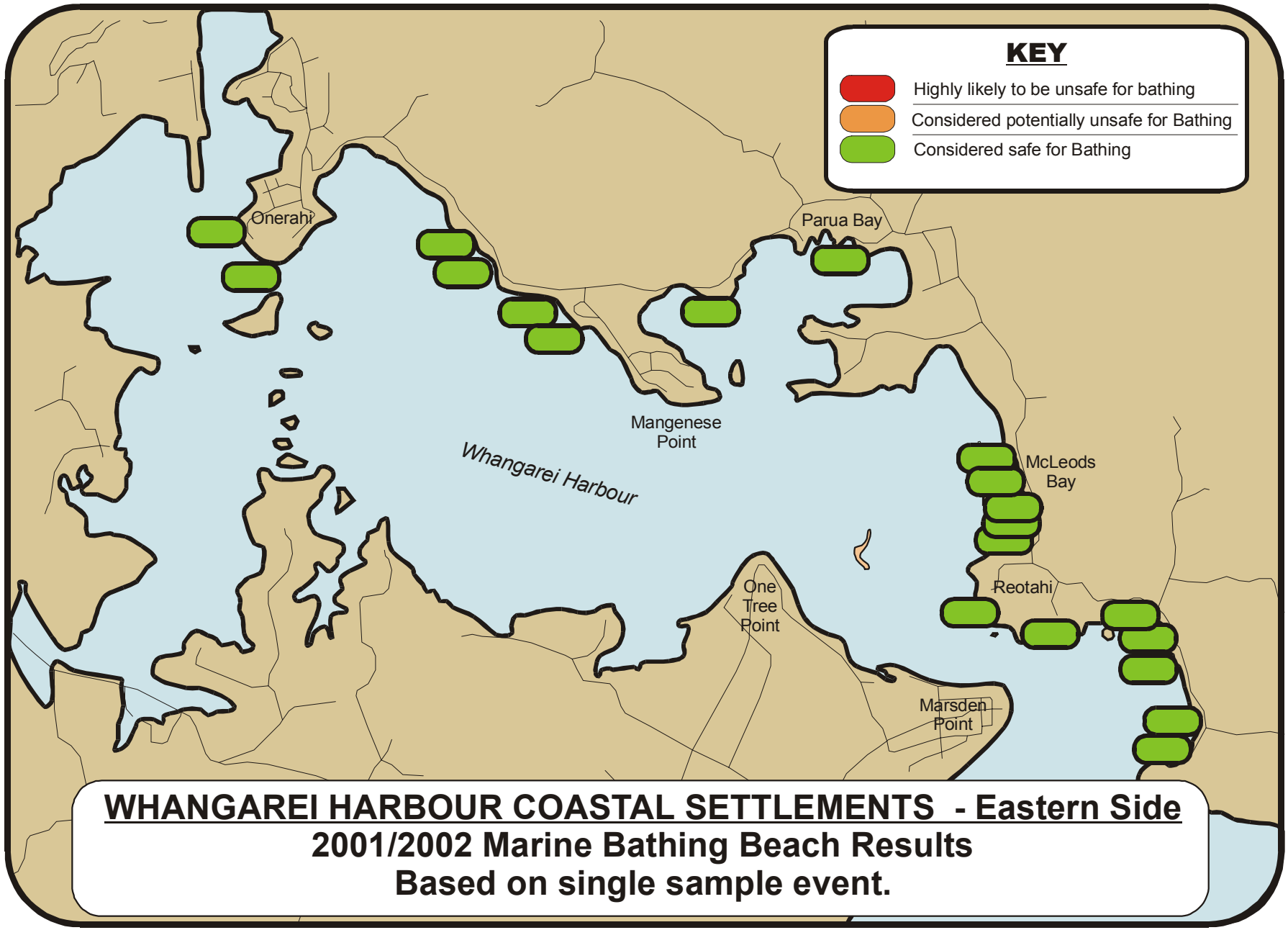
2001/2002 Marine Bathing Beach Results

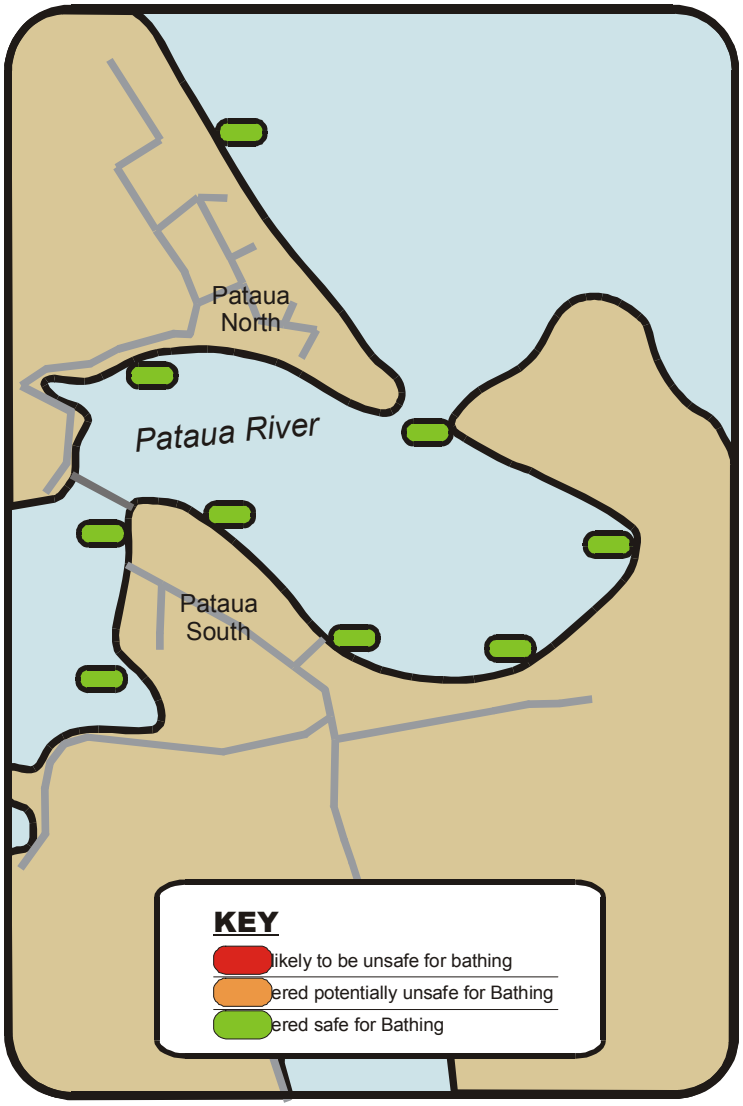
All results based on end of season median data.


KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
School
Store
Waitoi Creek
Camping Ground
Ngunguru River
NGUNGURU
2001/2002 Marine Bathing Beach Results
All results based on end of season median data.


KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
Whananaki
School
Whananaki Inlet
Spit
Footbridge
WHANANAKI
2001/2002 Marine Bathing Beach Results
Based on single sample event


TAIPA
KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
2001/2002 Marine Bathing Beach Results
All results based on end of season median data.
COOPERS BEACH

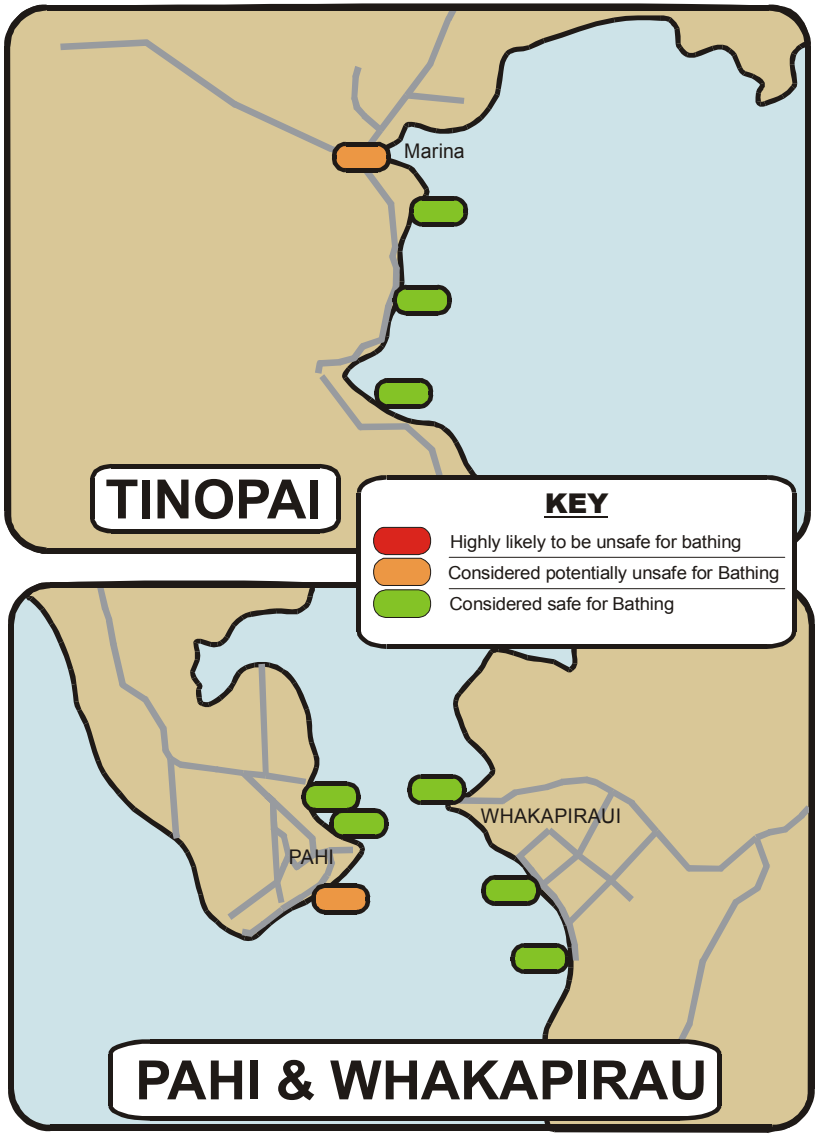

KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
Onerahi
Parua Bay
Mangenese Point
Whangarei Harbour
McLeods Bay
Reotahi
One Tree Point
Marsden Point
WHANGAREI HARBOUR COASTAL SETTLEMENTS - Eastern Side
2001/2002 Marine Bathing Beach Results
Based on single sample event.



PATAUA

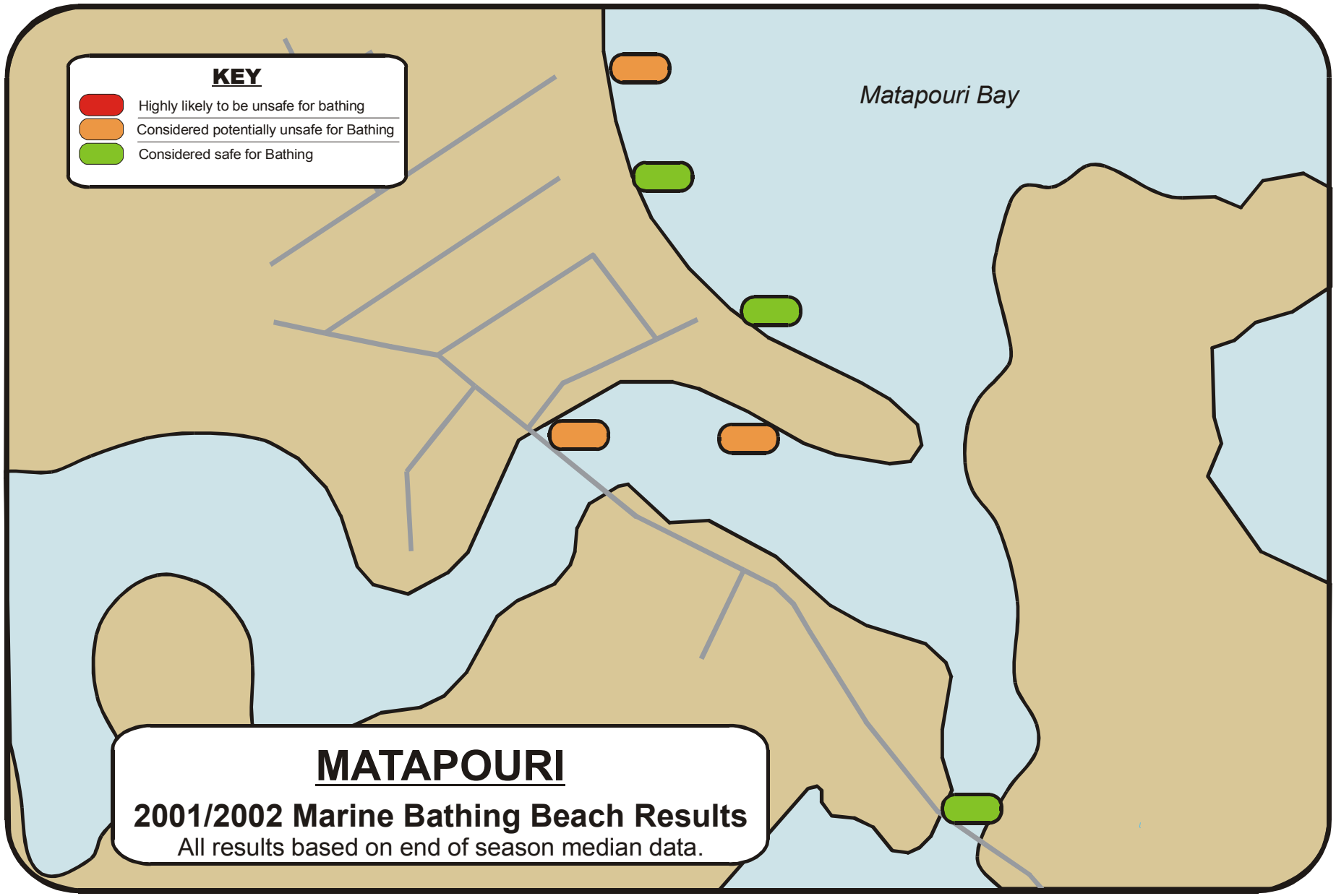
2000/2001Marine Bathing Beach Results

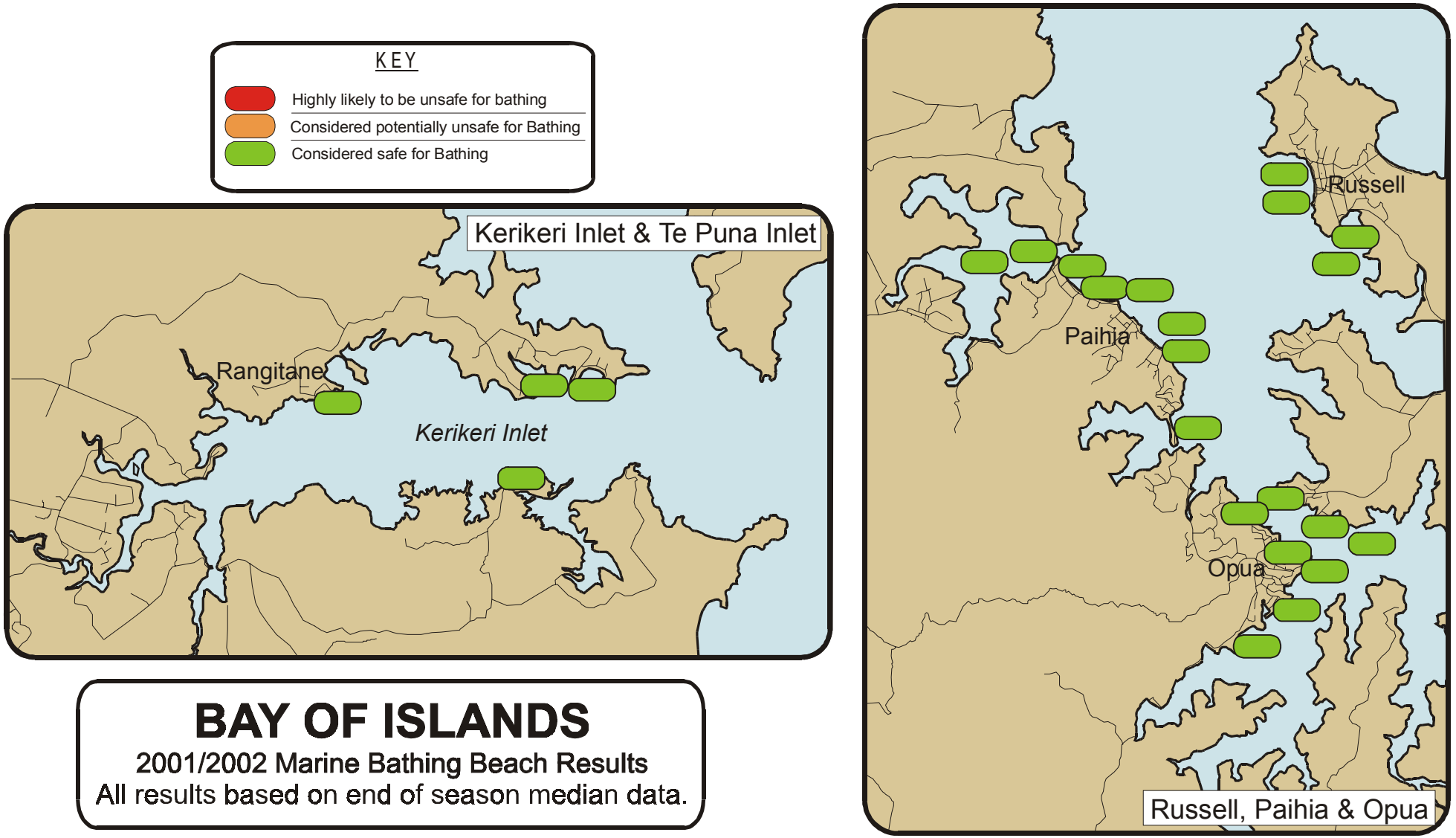
All results based on end of season median data.



2001/02 Marine Bathing Beach Results

All results based on end of season median data.


KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
Matapouri Bay
MATAPOURI
2001/2002 Marine Bathing Beach Results
All results based on end of season median data.


KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
Kerikeri Inlet & Te Puna Inlet
Rangitane
Kerikeri Inlet
Russell
Paihia
Opua
Russell, Paihia & Opua
BAY OF ISLANDS
2001/2002 Marine Bathing Beach Results
All results based on end of season median data.

Whangarei Harbour Water Quality

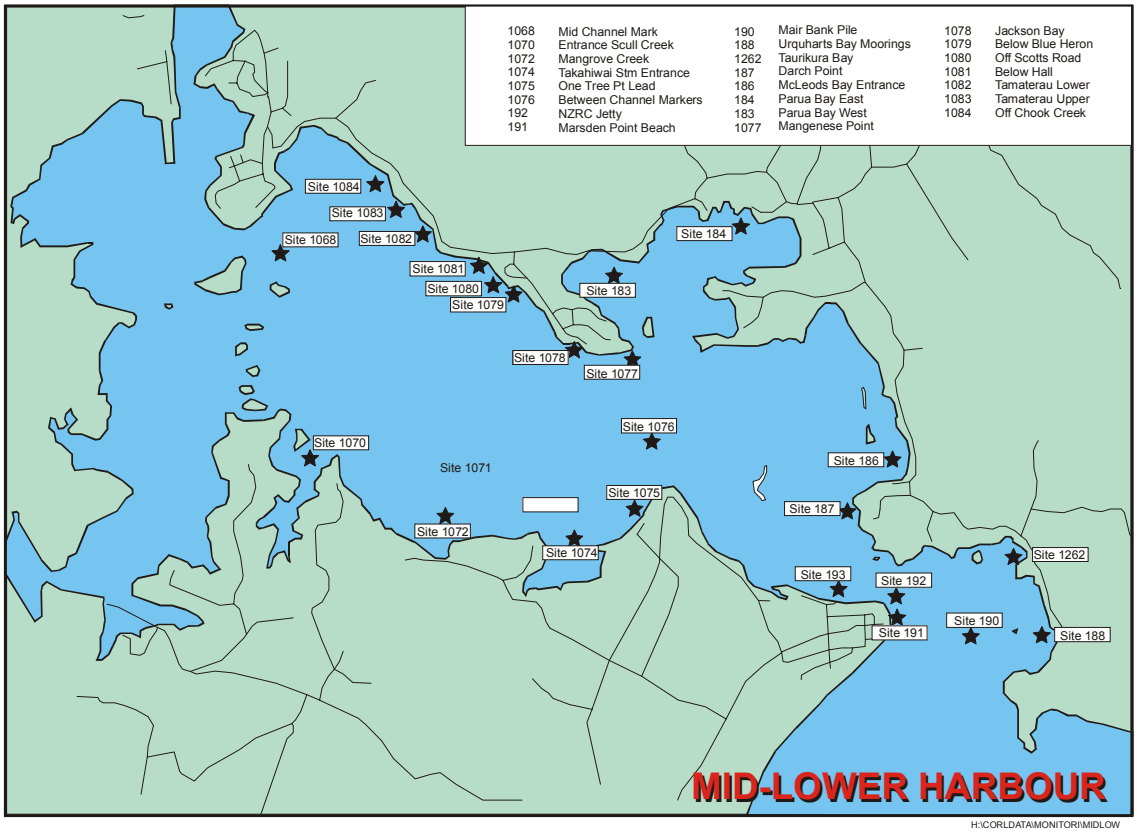
The Whangarei Harbour and catchment are the most developed of the region's twelve harbours, with urban and industrial areas covering 15% of its 300 km^2 catchment area.

Water quality in Whangarei Harbour has been regularly monitored since the beginning of 1986. The monitoring programme consists of an "Upper Harbour" boat run (15 sites between Onerahi and the Town Basin), and a "Mid to Lower Harbour" boat run (23 sites between Onerahi and Whangarei Heads). Salinity, temperature and dissolved oxygen concentration were recorded at each site and a sample was taken and tested for indicator bacteria. Nutrients were assessed at 5 sites for the Upper Harbour six times per year, and at 6 sites for the Mid-Lower Harbour four times per year.

The indicator bacteria sampled for were faecal coliform and enterococci. These are associated with humans, mammals and birds, and the level of these bacteria in water provides an indication as to the level of contamination from animal excrement and sewage. These have been sampled since 1999.

The nutrients tested for are phosphorus and nitrogen, which play a major role in the primary production of coastal ecosystems. The measurement of these nutrients provides an insight into the impact of adjacent land use practices on harbour water quality.

Mid-Lower Whangarei Harbour



Map 6.1. Mid Lower Whangarei Harbour Sites

Table 6.1: Median and range results for various parameters for the Mid-Lower Whangarei Harbour run.

	Median	Range	Standard
DO (g/m^3)	7.6	7.2-8.2	
ENT (n/100ml)	10	10	<35
FC (n/100ml)	2	2-8	<150
NNN (g/m^3)	0.017	0.009-0.041	0.015
NH4 (g/m^3)	0.05	0.01-0.09	
pH	8.1	7.9-8.2	
SAL (g/l)	34.1	33-35.15	
TEMP (Deg. C)	17.8	16-19.6	
TP(g/m^3)	0.0225	0.014-0.032	0.03

The quality of water for the 2001-2002 season in the mid-lower Whangarei Harbour was generally good, as outlined in Table 6.1. Faecal Coliform and Entercocci were both low and well within the standards considered safe for bathing. The median for nitrogen was slightly elevated above the standard for estuarine locations while total phosphorous was below the standard of 0.03 g/m^3

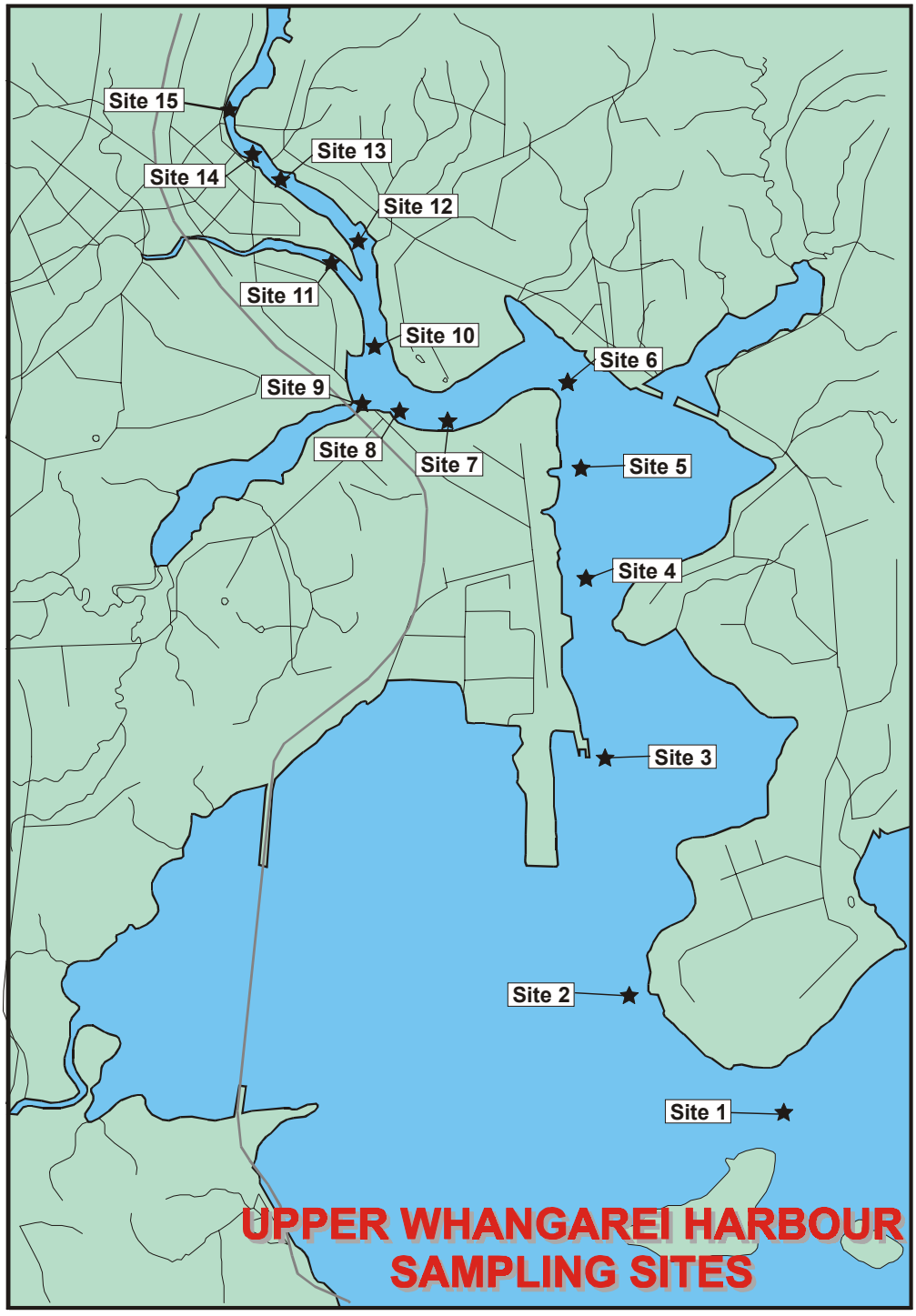
Upper Whangarei Harbour

Table 6.2 outlines the Results (median and range) for the 2001-2002 Upper Whangarei Harbour Run season. Levels for bacteria and nutrients are all significantly elevated in comparison with the Lower Harbour.

Table 6.2: Median and range results for various parameters for the Upper Whangarei Harbour run.

	Median	Range	Standard
DO (g/m^3)	6.8	6.1-7.65	
DO %	77.15	65.4-88.6	
ENT (n/100ml)	42	10-175	<35
FC (n/100ml)	100	4-630	<150
NNN (g/m^3)	0.175	0.04-0.434	0.015
NH4 (g/m^3)	0.1	0.08-0.21	
pH	7.9	7.5-8.0	
SAL (g/l)	30.1	21.3-31.8	
TEMP (Deg. C)	18.2	16.75-18.4	
TP (g/m^3)	0.092	0.048-0.137	0.03

Upper Whangarei Harbour



Map 6.2: Upper Whangarei Harbour Sampling Sites

Figure 6.2 illustrates the median faecal coliform count for each site in the 2001-2002 season. Counts from Limeburners Creek (site 9) and downstream generally fall within the guidelines for levels considered safe for bathing. Above Limeburners Creek, counts fall into the bathing safety status of "potentially unsafe for bathing". The median faecal coliform count above the Hatea River bridge was at a level considered to be highly likely to be unsafe for bathing.

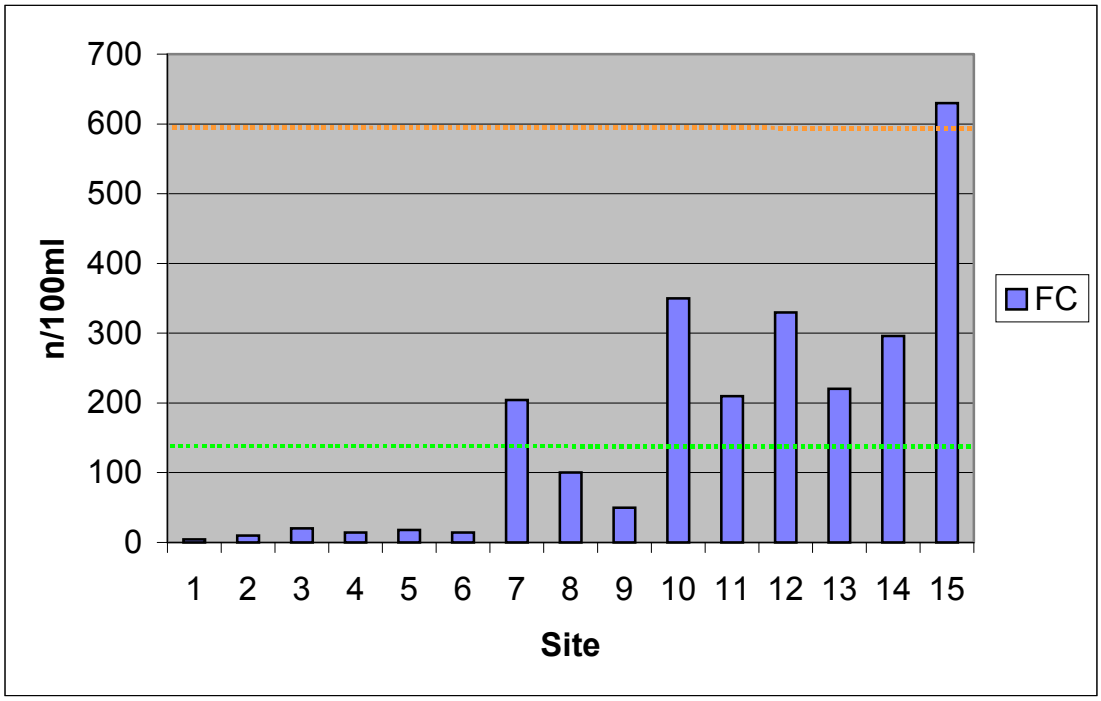


Figure 6.2: Faecal Coliform Counts for the Upper Harbour Run. Dashed green line indicates the upper boundary for safe bathing; dashed orange line indicates the upper boundary for areas considered potentially unsafe for bathing; above the dashed orange line indicates areas highly likely to be unsafe for bathing

Entercocci levels show that counts are within the guidelines for areas considered safe for bathing from Kissing Point, downstream. Above Kissing Point counts fall into the category of sites considered potentially unsafe for bathing.

When taken in combination: sites from Onerahi to Kissing Point are considered safe for bathing; Upstream from Kissing Point to the Town Basin is considered potentially unsafe for bathing; and upstream of Hatea Bridge is highly likely to be unsafe for bathing.

The nitrogen and total phosphorous levels for five sites on the Upper Harbour run are depicted in figure 6.3. As shown, all sites from Kissing Point (site 6) upstream, are well above the trigger levels for both nitrogen and total phosphorous.

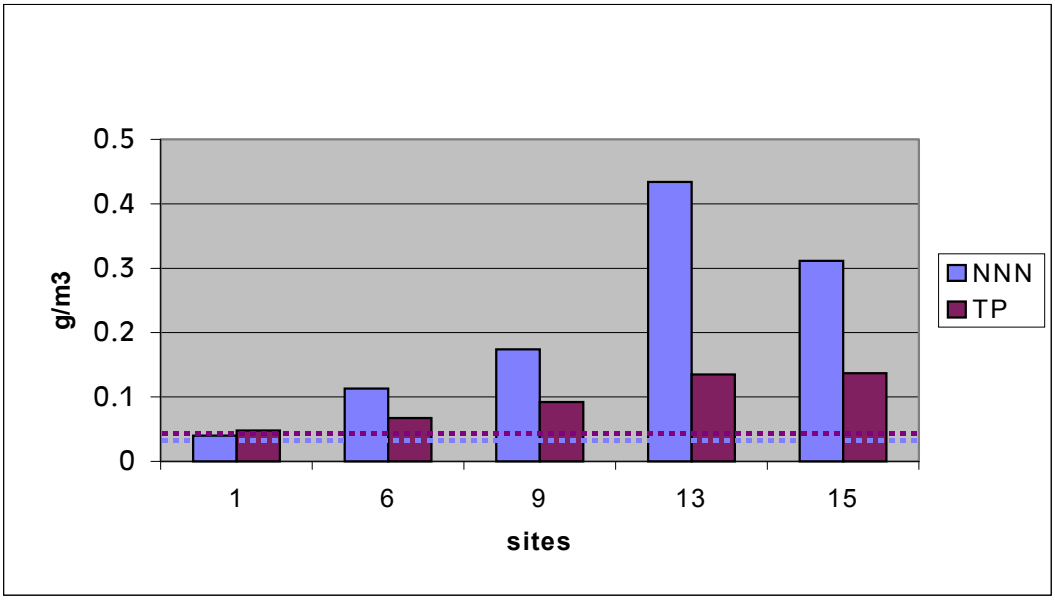


Figure 6.3: Nitrogen and Phosphorous counts for the Upper Harbour run. The dashed line represents the ANZECC (2000) trigger guidelines for each nutrient (as depicted in its respective colour).

Median faecal coliform counts for each site during the 1991-92, 1995-96 and 2001-02 seasons are shown in figure 6.4. One of the major trends that can be seen is an overall decrease in the levels of faecal coliforms for the 2001-02 season. Also of interest is the substantial decrease in faecal coliform counts at Limeburners Creek (site 9) and downstream. This reflects the upgrade of the Whangarei main Wastewater Treatment Plant during 1989-1990, since the Treatment Plant discharges to Limeburners Creek.

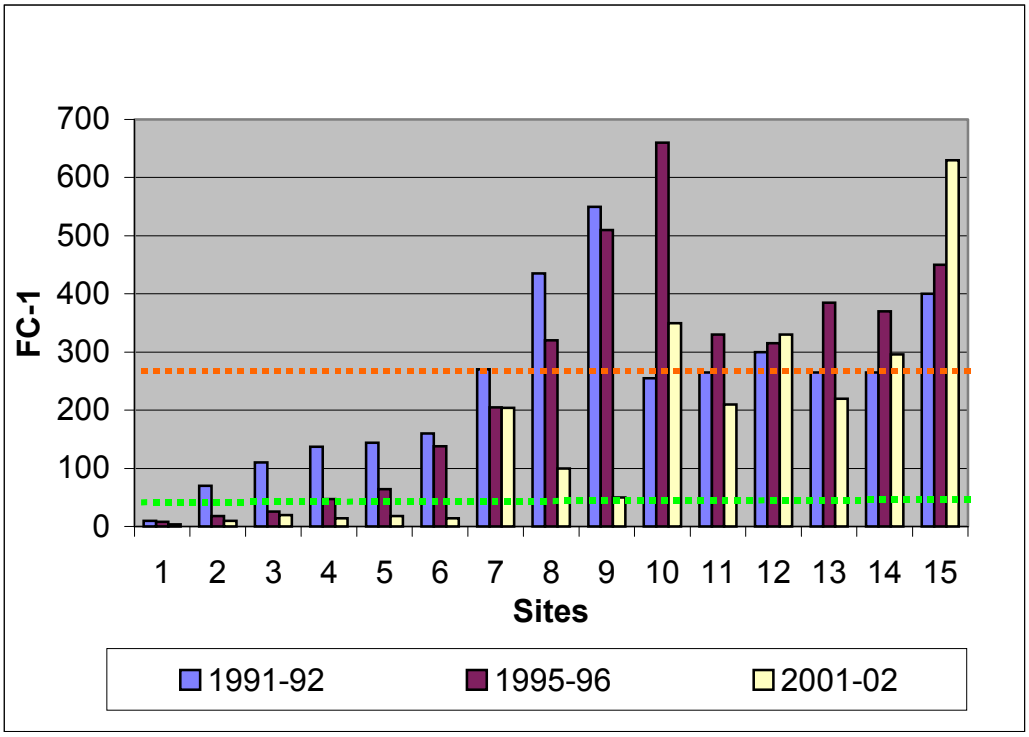


Figure 6.4. Faecal Coliform counts for the Upper Harbour Run for 1991-92, 1995-96 and 2001-02 seasons. Dashed green line indicates the upper boundary for safe bathing; dashed orange line

indicates the upper boundary for areas considered potentially unsafe for bathing; above the dashed orange line indicates areas highly likely to be unsafe for bathing.

The Kaipara Sand Study

In 1997 the Minister of Conservation granted resource consents to Winstone Aggregates Ltd and Mt Rex Shipping to extract sand from an area inside the entrance to the Kaipara Harbour.

A condition of these consents required that a study into the sustainability of sand extraction and an assessment of the sand reserves of the Kaipara Harbour inlet be undertaken.

In early 2000 the National Institute of Water and Atmospheric Research (NIWA) were contracted to undertake this study, which is termed the 'Kaipara Sand Study'. The study is being funded by the consent holders, and the Auckland and Northland Regional Council's.

The objectives of the study are to:

- Describe the processes and quantify rates of sediment transport.
- Provide an assessment of the physical effects of sand extraction on the extraction area and other areas in the Kaipara Harbour.
- Determine the volume of sand extraction that can be sustained.
- Determine an appropriate programme for monitoring the effects of sand extraction.

The following components make up the Kaipara Sand Study:

- Historical Sand Movement – Maori and European Knowledge.
- Historical Sand Movement – Geomorphic Evidence.
- Amount of sand in the system.
- Sediment mapping.
- Sand transport processes in subtidal and intertidal areas.
- Sand transport along the shoreline.

Some of these components have already been completed, whilst others are nearing completion. The draft final report for the Kaipara Sand Study is scheduled for completion by late 2002.

Figure 6.5: Left to right; the Pouto shoreline and dune system, which comprise part of the area of the Kaipara Sand Study.

Estuarine Monitoring Protocol (EMP)

Background to the EMP

Since 1999 the Northland Regional Council, along with several other regional councils, has been contributing towards the development of a national monitoring protocol to assess the state of health of estuarine environments. The Cawthron Institute is developing this protocol with funding provided from the various regional councils and the Ministry for the Environment's sustainable management fund.

The Cawthron Institute is developing this protocol as a project with the aim of developing and trialing a cost-effective monitoring approach using a suite of benthic characteristics as indicators of estuarine environmental health.

Since the inception of the project the Cawthron Institute has completed most of the development of the protocol and has implemented the protocol in field trials at a selection of estuaries throughout New Zealand. The Otamatea arm of the Kaipara Harbour was selected as one of the field trial estuaries.

The methodology and implementation of the EMP can be broken down into three basic groups of estuarine assessment techniques:

- Preliminary assessment of estuary condition for prioritising estuaries for monitoring.
- Broad-scale mapping of intertidal habitat characteristics.
- Fine-scale assessment of one key representative habitat using analyses of a suite of characteristics relevant to estuarine condition.

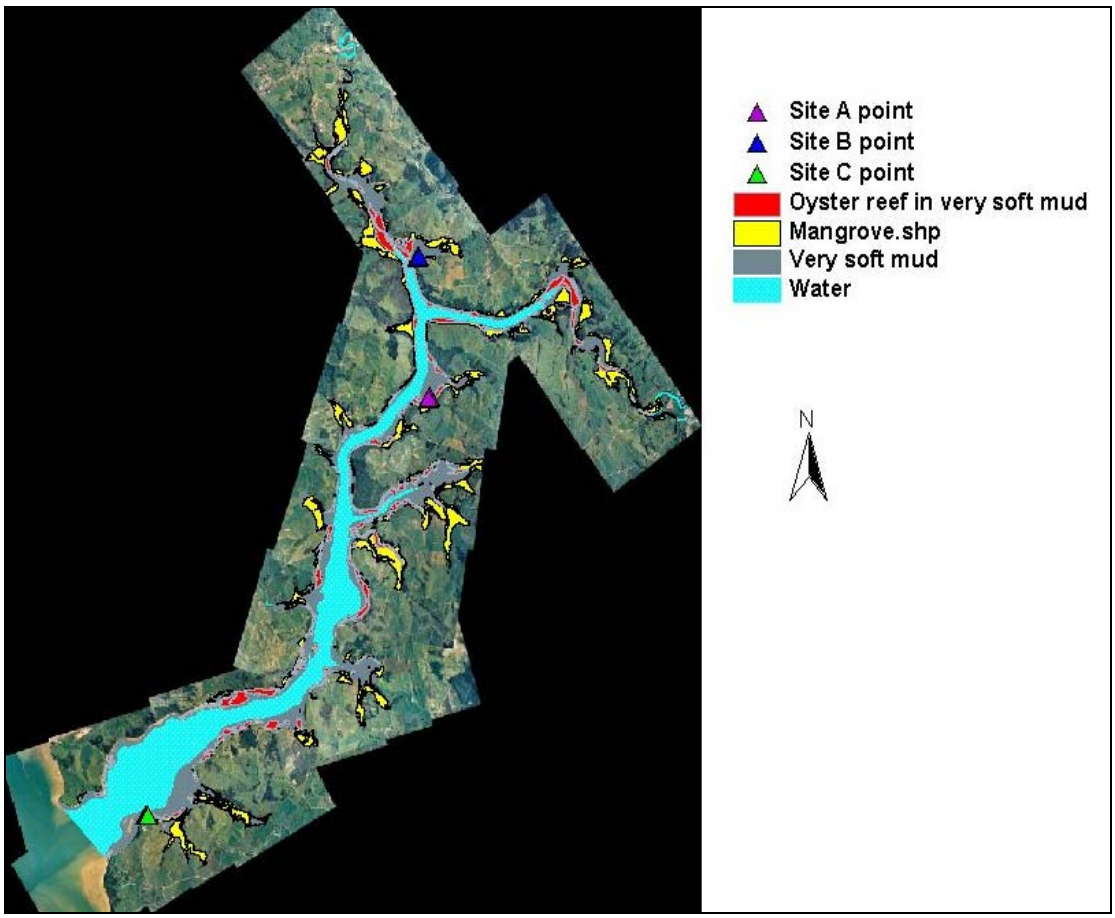
Outcomes from the Otamatea Field Trial

The Otamatea arm of the Kaipara Harbour was the most northern estuary selected by the Cawthron Institute as a field trial site in the development of the protocol. The fieldwork and analyses for the broad-scale habitat mapping and fine scale assessment have now been completed for the Otamatea arm. A summary of the results from this is presented in the following.

Broad Scale Mapping Results

The broad scale results show that the Otamatea Arm is characterised by a "narrow range of intertidal habitat types dominated by unvegetated substrate covering 40% of the estuary area (primarily very soft mud)". Other extensive habitats were mangrove scrubland, covering nearly 20% of the estuary (33 ha), and oyster shellfish beds covering 10% (165 ha) of the total estuary area. Approximately 40% of the total estuary area was comprised of subtidal water cover.

The extent and locations of these dominant habitat types are presented in the following GIS (Geographical Information System) map (map 6.2).



Map 6.2: An example of the result of the broad scale habitat mapping for the Otamatea Arm of the Kaipara Harbour. The four dominant estuarine habitat types of the Otamatea Arm and the location of the fine-scale sampling sites are displayed.

Fine Scale Assessment

Three representative sampling sites were selected for fine scale assessment in the Otamatea arm. Suites of parameters were measured at each site. In summary the results of this sampling demonstrated the following characteristics:

- a dominance of infaunal organisms (those living within the sediments).
- relatively low metal concentrations, which is indicative of low potential for toxicity impacts (Table Xx)
- relatively low organic content and nutrient concentrations of the sediment (Table Xx)
- sediments were mostly a very fluid mud, providing a generally unsuitable habitat for epifaunal organisms (those living on the sediment surface)
- the above two characteristics may be responsible for limiting the species abundance and diversity of both the infaunal and epifaunal macroinvertebrates

Mangrove trees, oyster shellfish beds and subtidal water cover of the Otamatea arm of the Kaipara Harbour. These are three examples of the more extensive habitat type defined in the broad scale habitat mapping.

The Future of the EMP and Implementation for Northland

The overall development of the EMP is scheduled for completion in late 2002. Once completed the EMP will provide the Northland Regional Council with a standardised approach for assessing the current state of Northland's estuaries.

The Northland Regional Council will be looking to implement the EMP in the near future. Initially this will involve a preliminary assessment of estuary condition for prioritising estuaries for monitoring. Once prioritised, the broad scale and fine scale assessments will be undertaken at several of the highest priority estuaries in Northland.

Coastal Hazard Review

A coastal hazard is considered to arise as a result of natural phenomena such as storm surge, tsunami and other wave action resulting in either erosion (Figures Xx & Xx), landslip or flood inundation.

Coastal Hazard Zones (CHZ) identify coastal areas that are subject to, or are likely to be subject to adverse effects from identified actual or potential natural coastal hazards. CHZ are shown on appropriate plans and are a way of satisfying the requirements of the Resource Management Act 1991 (S. 106, RMA 1991), New Zealand Coastal Policy Statement 1994 (Policy 3.4, NZCPS 1994), Building Act 1991 (S. 36, BA 1991), and NRC's Regional Policy Statement and Revised Proposed Regional Coastal Plan.

Identification and surveys of the potential coastal hazards that exist in Northland were carried out originally in several former county areas within the Northland Region:

- Whangarei county area (*NRC* 1988)
- Former Mangonui county area (*NRC* 1991)
- Omapere-Opononi area (*NRC* 1991)

Studies of the coastal hazard zones and processes along sections of Northland's coast show that certain areas are extremely dynamic, with large areas of mobile sands, such as the areas around the tips of many of Northland's sand spits. Traditionally, people have built too close to these and other areas such as foredunes. Some properties are now situated in areas considered to be 'high risk'.

Improved scientific understanding and international literature has resulted in changes to the methodology for the assessment of coastal hazards. As original assessments were conducted approximately 10 years ago, it is now appropriate to review the CHZ.

Erosion of the Omapere foreshore. An example of a coastal hazard. The Coastal Hazard Zone for this area is currently under review.

Hazard Review Methodology

Nearshore profiles are collected using a small boat and depth sounder and extended up the foreshore to include the foredune using a theodolite and Electronic Distance Metre (EDM). The seaward edge of the foredune is mapped using Global Positioning System (GPS) equipment, with dune crest heights established using theodolite and EDM survey equipment.

This information is then incorporated with historical survey information and used to determine the extent of both short term and long-term erosion episodes. This then allows development of the CHZ, which are adopted into the District Council's district plans.

Coastal Hazard Review 2001-2002

A review of some erosion prone areas and areas that have not previously been surveyed was commenced in 1999. Preliminary site investigations and fieldwork were undertaken at most sites. The areas which have been reviewed include: Helena and Teal Bay, Taupo Bay, Hihi and Rangiputa. CHZ information has also been developed for Tauranga Bay, Coopers Beach, Cable Bay, and Taipa.

Further work is still being carried out for Ahipara, Opononi-Omapere and Te Ngaire and the CHZ will be completed in 2002.

Case Study: Mangawhai Spit Monitoring; an example of coastal monitoring

Why Monitor Mangawhai Spit?

Resource consents granted to SeaTow Ltd and Norsand Ltd in 1992 permit sand extraction from the mouth and tidal inlet of the Mangawhai Harbour. These consents permit an annual combined volume for removal of up to 50,000 m^3 of sand.

Due to the possible consequences of the sand extraction on the dynamics of the system (i.e. reduced volumes of sand in the system may assist coastal erosion) it was considered important to routinely monitor the stability of the spit morphology to ensure any effects that may be linked to extraction (i.e a continuously and/or rapidly retreating shoreline) are detected early. If effects are detected, then appropriate actions can be taken to limit or cease sand extraction to minimise adverse effects to the geomorphology of the spit.

The distal end of Mangawhai Spit as seen from Mangawhai. The sporadically vegetated and undulating dunefield is characteristic of the distal end of the spit.

What is Monitored and How?

The Northland Regional Council monitors the stability of the northern spit geomorphology every six months. This monitoring was first implemented in 1999.

Monitoring methods include the use of standard survey methods and differentially corrected GPS (Global Positioning System). Five cross-shore profiles of the spit are undertaken from surveyed benchmarks (figure 6.6) and GPS surveys of the toe of the foredune and mean high water mark are also undertaken.

This monitoring enables the Northland Regional Council to detect changes to the morphology of the spit and make informed decisions on the sustainability of the extraction in terms of likely effect on the spit stability.

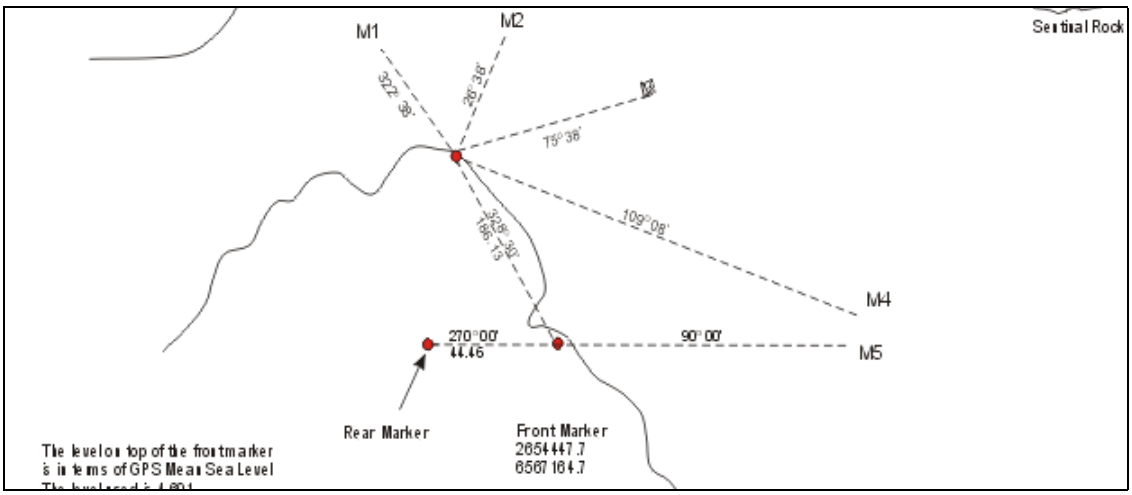


Figure 6.6: Location of Mangawhai survey sections and benchmarks.

What Has the Monitoring Shown?

Stability of the toe of the foredune:

The foredune is an integral part of any coastal system as this area acts as a buffer zone between the sea and the land retreating and accreting during storm and fairweather events respectively, or remaining static when in equilibrium. The toe of the foredune is located at the seaward base of the dune. This dune feature provides a useful reference line from which to measure dune stability over time.

- The maximum change to the toe of the foredune appears at the northeastern end of the spit where up to 25 - 30 metres of retreat has occurred.
  - This was most noticeable for the December 1999 to April 2001 period, after which the rate of retreat appears to have slowed during the April 2001 to April 2002 period.
  - It is possible that the bulk of this retreat may be resulting from the effect of storm events.
- Pockets of accretion are evident in several locations on the western side (estuary) of the spit.
- In summary, the toe of the foredune has remained relatively stable since the commencement of monitoring, especially considering the dynamic nature of barrier spit systems.

Dunes showing contrasting states of 'health'. On the left a well vegetated foredune and to the right a scarped foredune indicative of recent erosion.

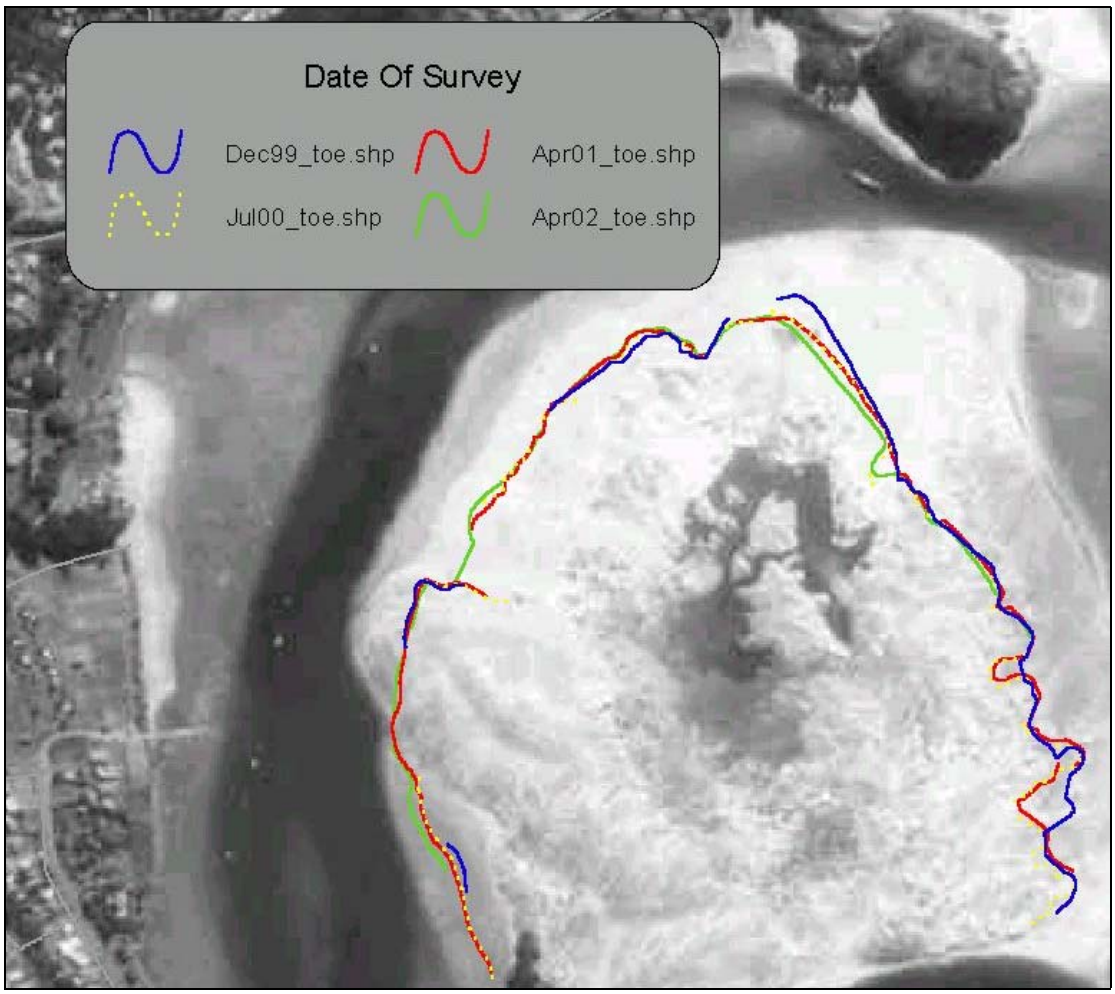


Figure 6.7: The coloured lines on Mangawhai Spit represent the toe of the foredune from GPS surveys undertaken in December 1999, July 2000, April 2001 and April 2002. The lines are overlain from a 1996 aerial photograph of Mangawhai.

Cross Shore Profiles:

Cross shore profiles measure the height of a beach relative to a known datum. These profiles enable changes in volumes of sediment over the intertidal beach profile to be determined and also enable the identification trends in the general 'health' of a beach over time.

- Since July 2000 to present the profiles have showed sporadic episodes of erosion and accretion.
- There appears to be a seasonal influence on these events, with a typical pattern appearing of accretion in summer and erosion in winter.
- The overall pattern evident in the profiles is for erosion on the northeast part of the spit (profile M1), graduating to mixed erosion and accretion further south (profiles M2 & M3) and greater accretion even further south (profile M5).

Table 6.3: Generalised summary of profiles. + indicates mostly accretion throughout profile, - indicates mostly erosion throughout profile and +/- indicates mixed erosion and accretion throughout profile.

	M1	M2	M3	M4	M5
27/7/00 - 5/04/01	+	+/-	+/-	+/-	+/-
5/4/01 - 21/08/01	-	-	-	-	+/-
21/08/01 - 09/04/02	+/-	+	+	+	+
27/7/00 – 09/04/02	-	+/-	+/-	+	+

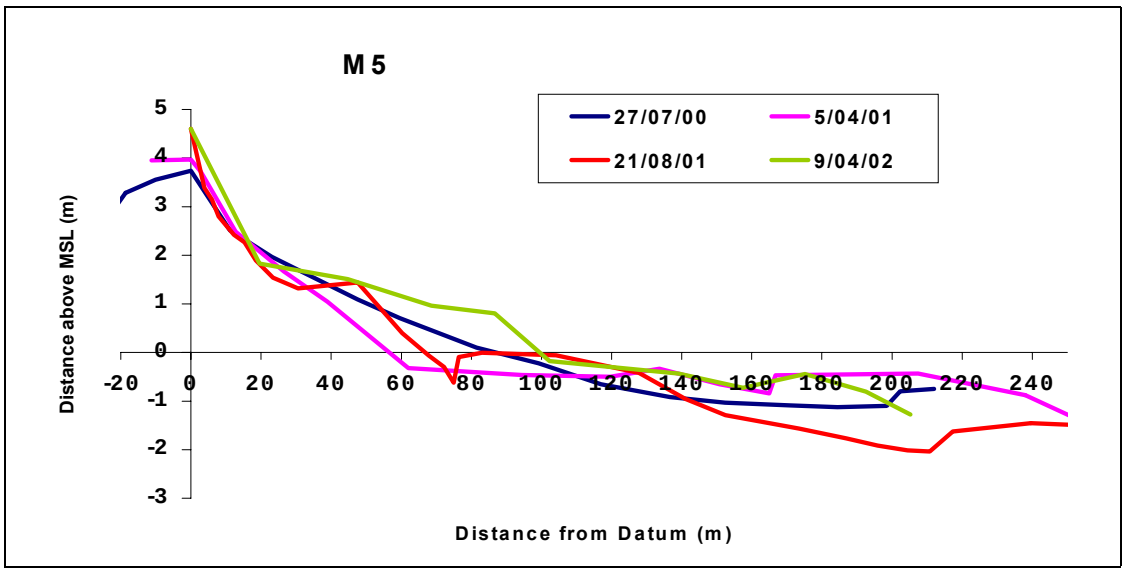


Figure 6.8: An example of the cross shore profile data. This is profile M5.

Overall:

- Monitoring shows that Mangawhai Spit is remaining relatively stable, considering that barrier spit systems are dynamic coastal features by nature.
- Natural processes appear to be forcing observed short-term changes between summer and winter.
- Further data are required before significant trends can be deducted.