6 COASTAL MONITORING

Overview

- The bacteriological water quality survey conducted over the summer of 2002/2003 showed that 9% of sites were potentially unsafe for bathing
- A survey of boat anti-fouling residues found elevated levels of diuron in the Tutukaka and Whangarei harbours. While below guideline values, an extension of current heavy metal monitoring programmes will be necessary to determine if such levels are restricted to the studied harbours or in fact reflect a widespread problem
- Heavy metal concentrations in the Whangarei harbour have declined at some sites, and are below "low effect" levels at all sampled locations
- The Coastal Hazard Review Programme has continued over the 2002/2003 period
- A study of sedimentation rates within the Hokianga Harbour has shown an increased accumulation rate in the northern (Tapuwae) catchment since the 1950s and a corresponding decreased rate in the major southern (Whirinaki) catchment over the same period

2002/2003 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:

- **Carry out sampling and reporting on summer coastal and freshwater bathing quality**
- **Support and contribute 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 working party for a study of sand resources, and associated coastal processes, of the Kaipara harbour, in conjunction with the Auckland Regional Council and sand mining industry**

6.1 Marine Bathing Water Quality

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, after heavy rainfall, the number of bacteria in coastal waters can increase and an elevated health risk may last for several days. In general, open coast locations are safer than estuarine or harbour locations, which may concentrate contaminants if tidal flushing is limited. 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 2002/2003

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. This survey was undertaken during the peak 2002/2003 bathing season (between December to January).

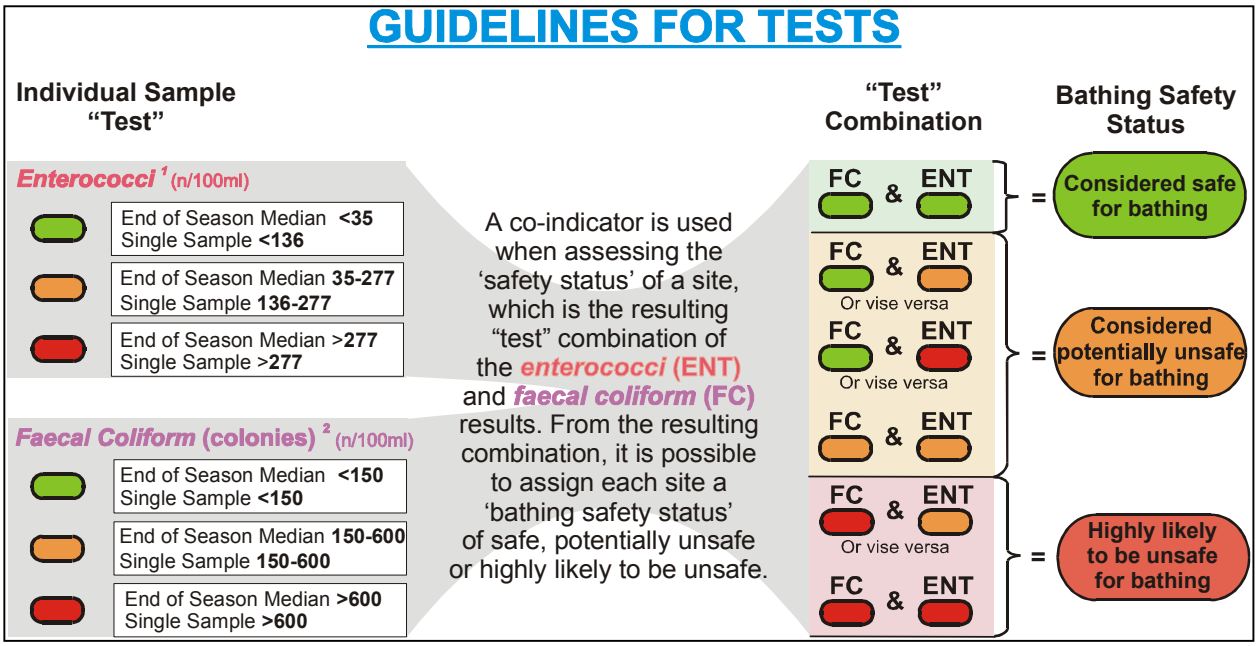
The results from the survey enable an assessment to be made as to the suitability of bathing areas for contact recreation. This assessment is based on the levels of indicator bacteria recorded in the water, and are indicative of pathogen levels and therefore the potential risk of illness to bathers.

Several sites were monitored, generally on at least five separate occasions, at each of the following locations in 2002/03:

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

6.1.1 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}.**

The Northland Regional Council believe that both Faecal Coliforms 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 at a single site is considered more indicative of a significant water quality issue than if only one or other was elevated.

6.1.2 Summary Results

A brief description of the water quality monitoring results for 2002/03 is given in the following section. 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

All sites within the Mangawhai Harbour were considered safe for bathing. This result is a departure from that of the previous three years, which have typically shown a number of sites that have been considered potentially unsafe for bathing.

Ngunguru Estuary

Four out of seven sites within the Ngunguru estuary were considered potentially unsafe for bathing due to elevated end of season median enterococci levels. 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.

Taipa and Coopers Beach

All the sites at Taipa and Coopers Beach were considered safe for bathing, as for the previous season.

Whangarei Harbour (Eastern settlements)

The settlements of the eastern Whangarei Harbour were only sampled on one occasion during the bathing season. Two sites near the mid-upper harbour area were considered potentially unsafe for bathing.

Pataua

One out of nine Pataua sites was considered potentially unsafe for bathing. It is possible that the elevated enterococci result at this site 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. Ngunguru) and may be an effect of the mangrove forest within the estuary, which can contribute to elevated enterococci bacteria levels.

Tinopai

All sites at Tinopai were considered safe for bathing.

Pahi and Whakapirau

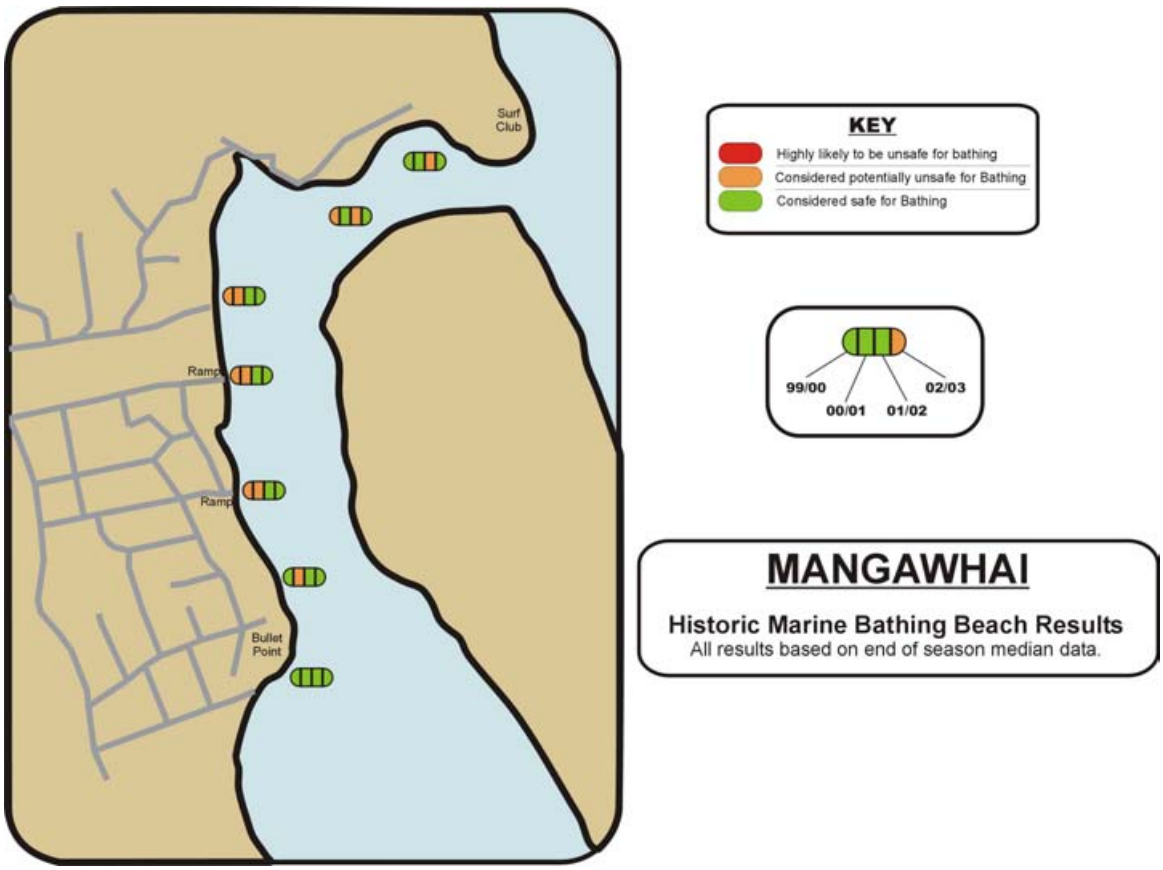
All sites at Pahi and Whakapirau were considered safe for bathing.

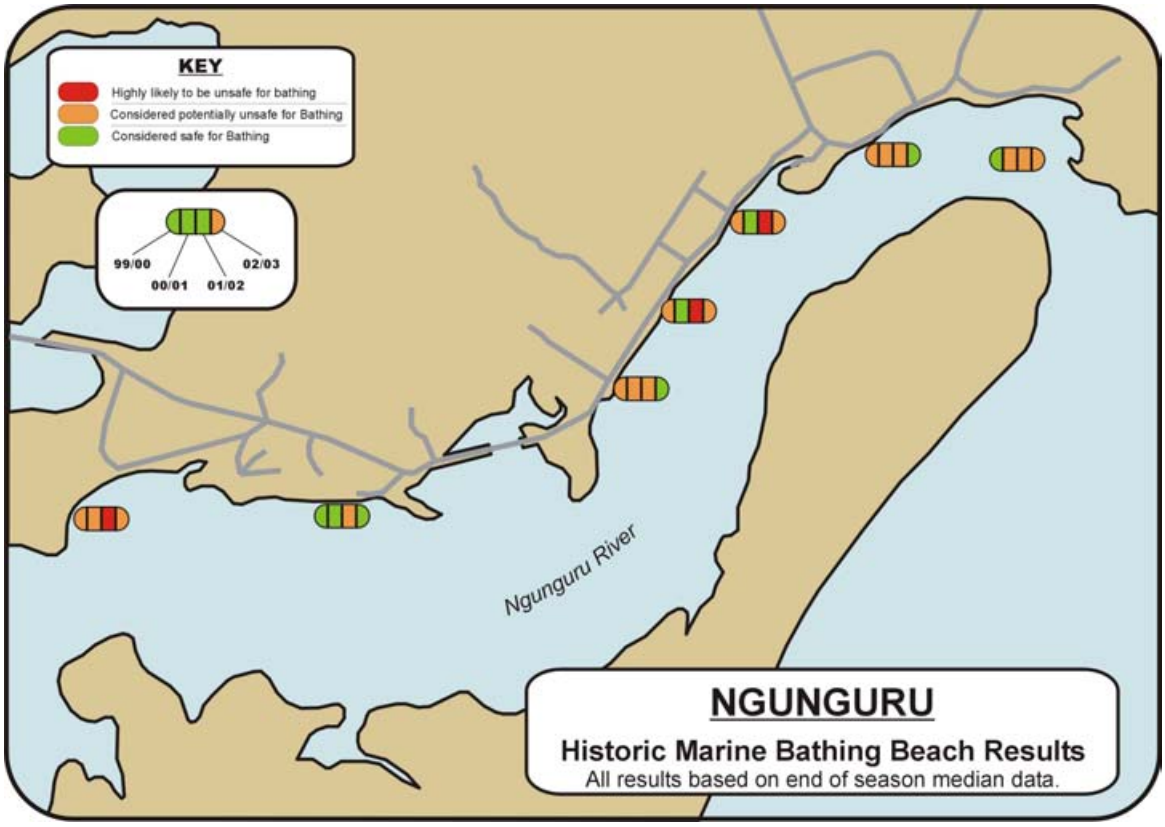
Matapouri Beach and Estuary

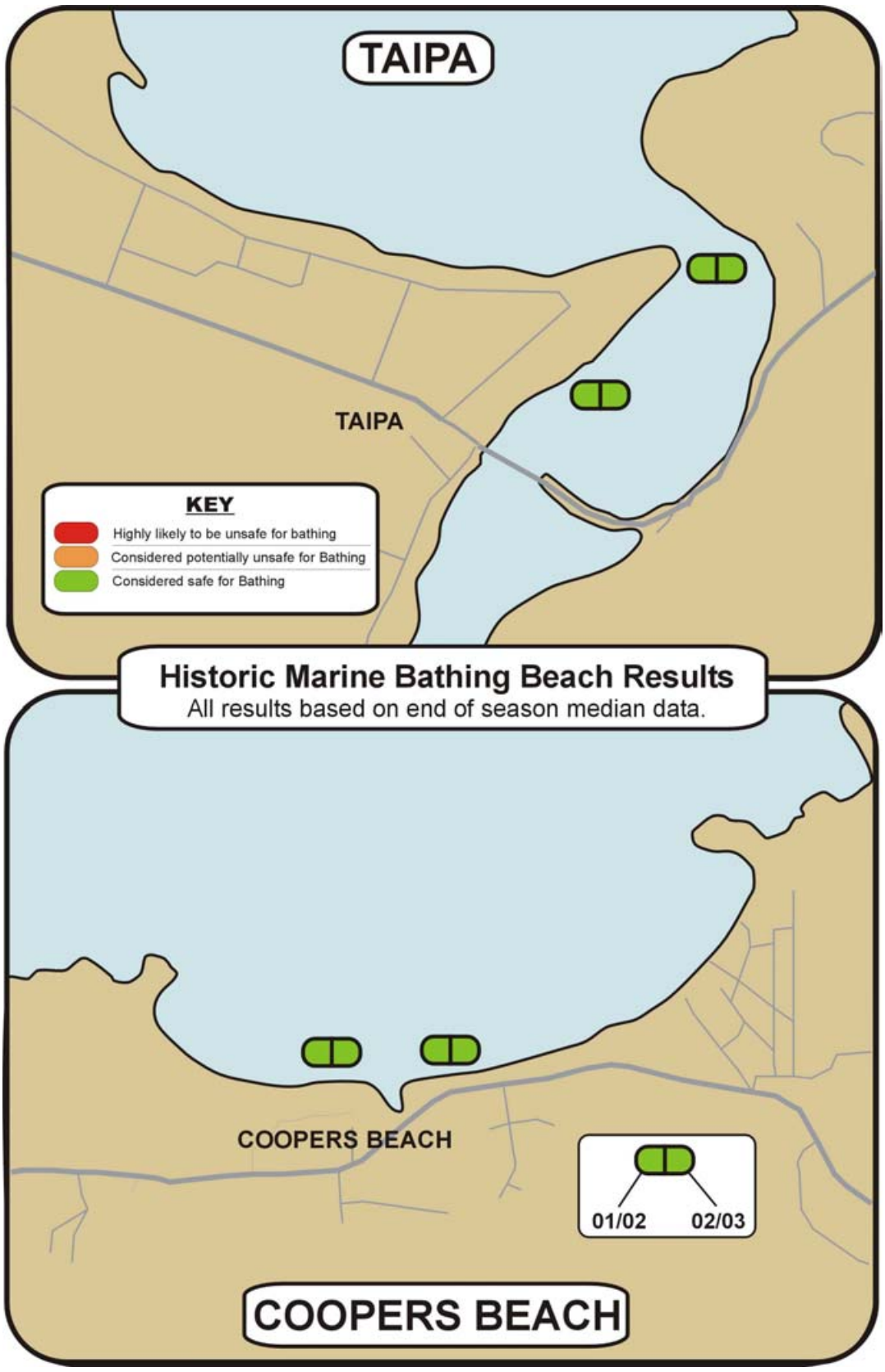
All sites at Matapouri were considered safe for bathing.

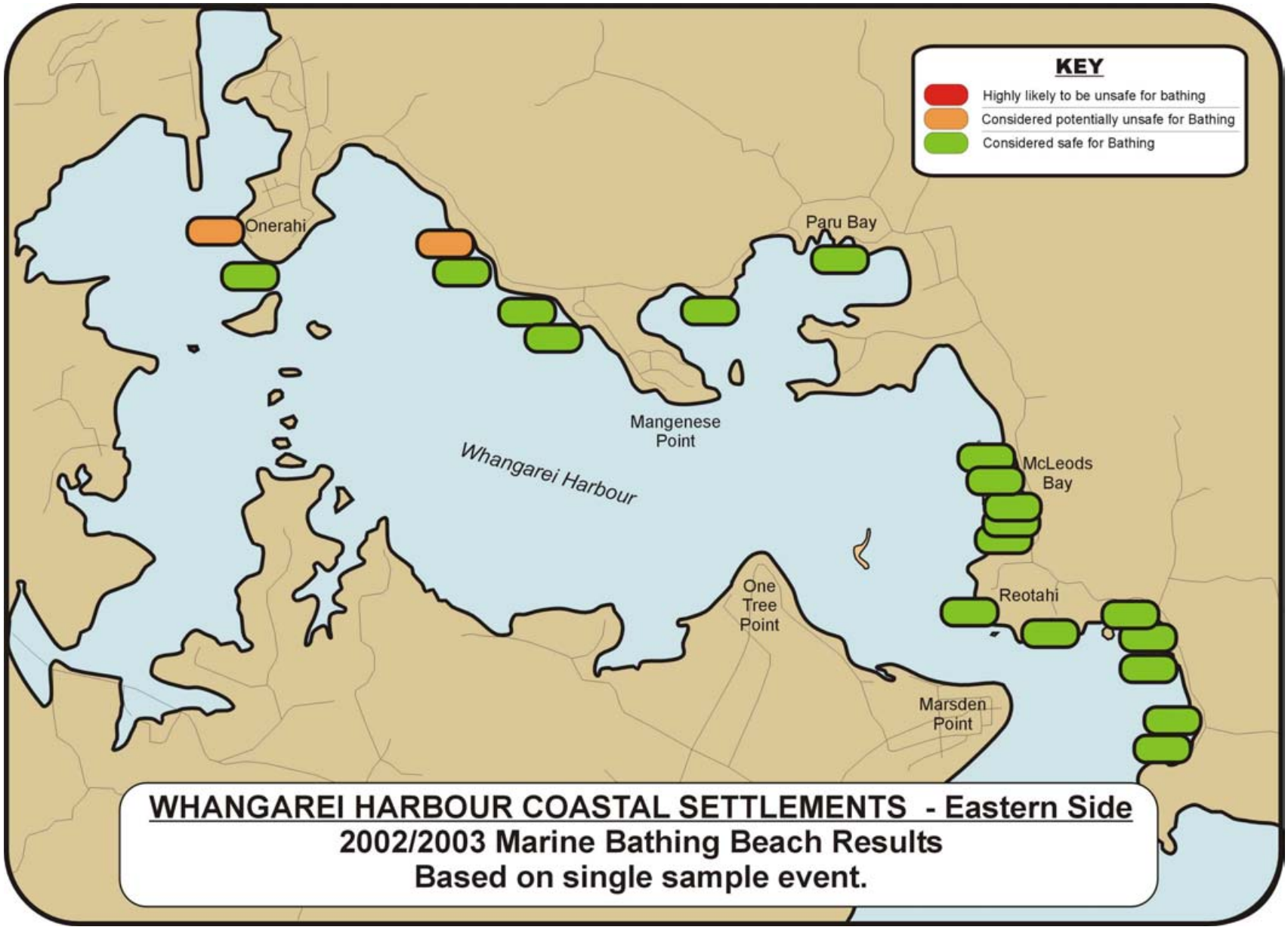
Bay of Islands (Opua, Paihia, Russell)

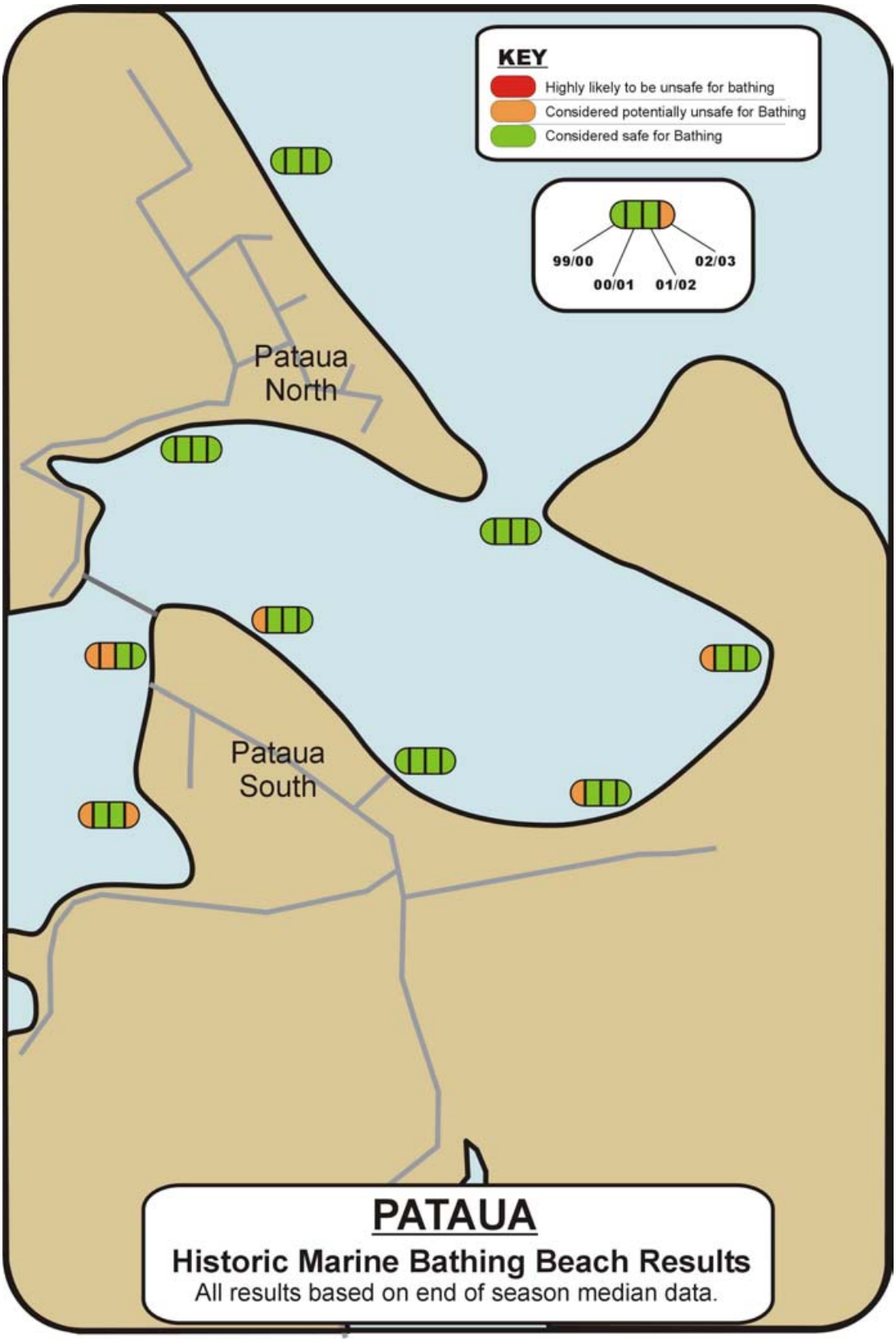
All sites sampled were considered safe for bathing, with the exception of one site in the Waitangi River.

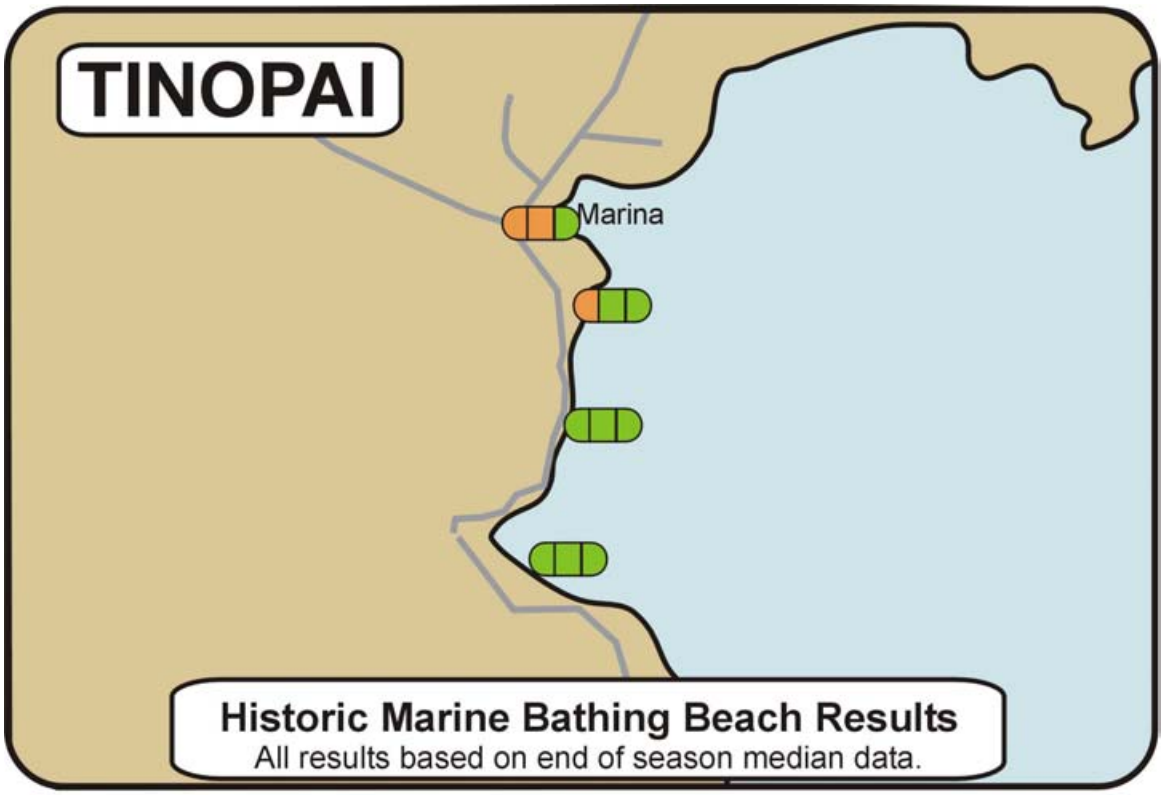

Surf Club
Ramp
Ramp
Bullet Point
KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
99/00
00/01
01/02
02/03
MANGAWHAI
Historic Marine Bathing Beach Results
All results based on end of season median data.

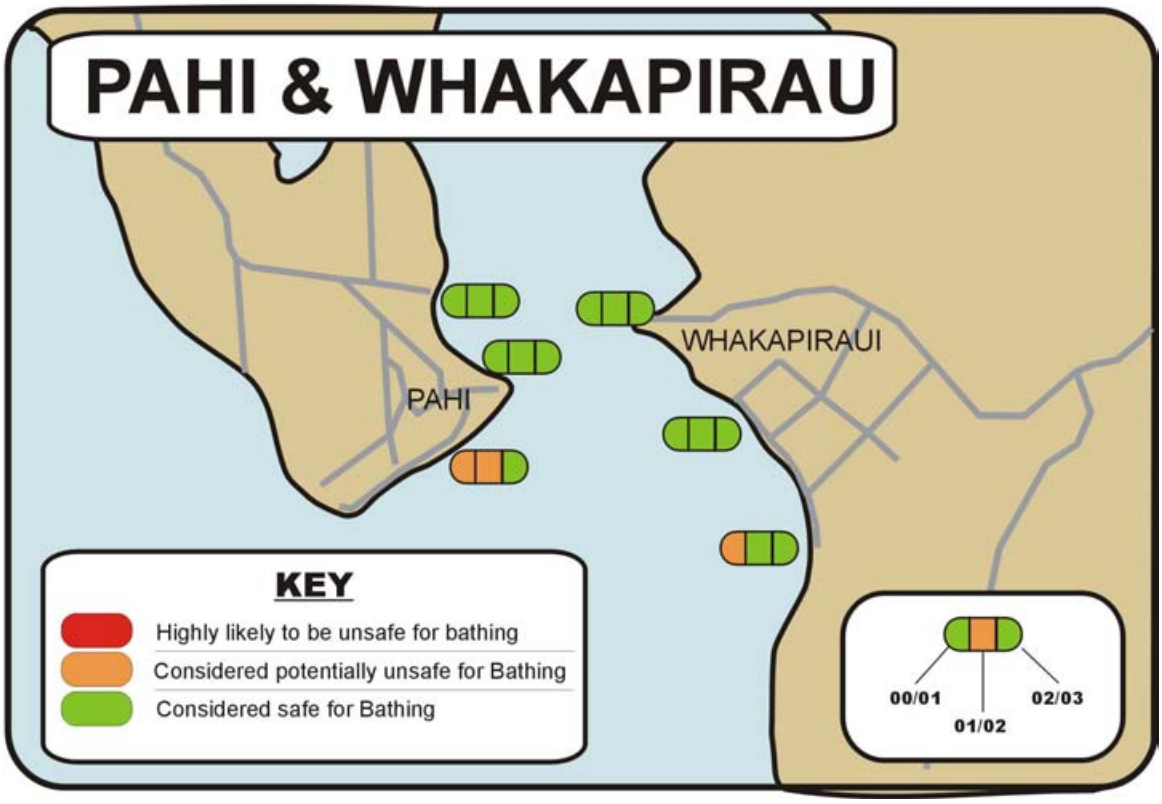

KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
99/00
00/01
01/02
02/03
Ngunguru River
NGUNGURU
Historic Marine Bathing Beach Results
All results based on end of season median data.

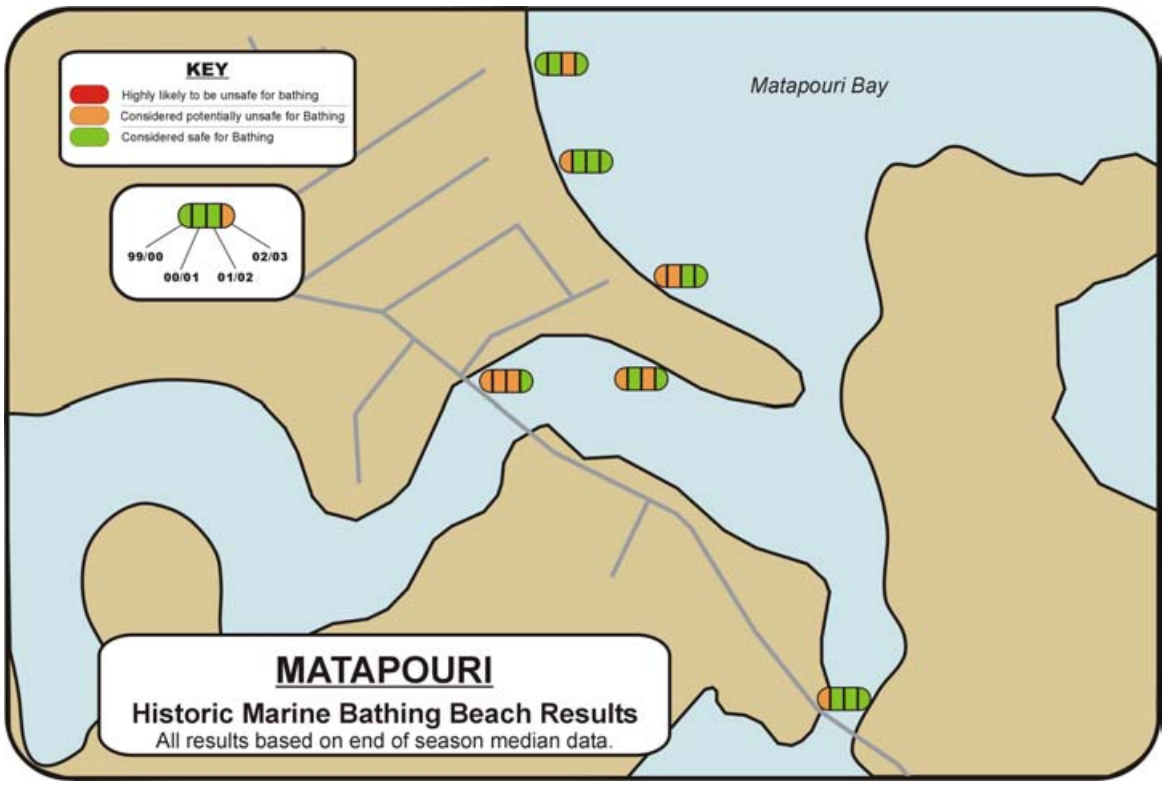

TAIPA
TAIPA
KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
Historic Marine Bathing Beach Results
All results based on end of season median data.
COOPERS BEACH
01/02
02/03
COOPERS BEACH

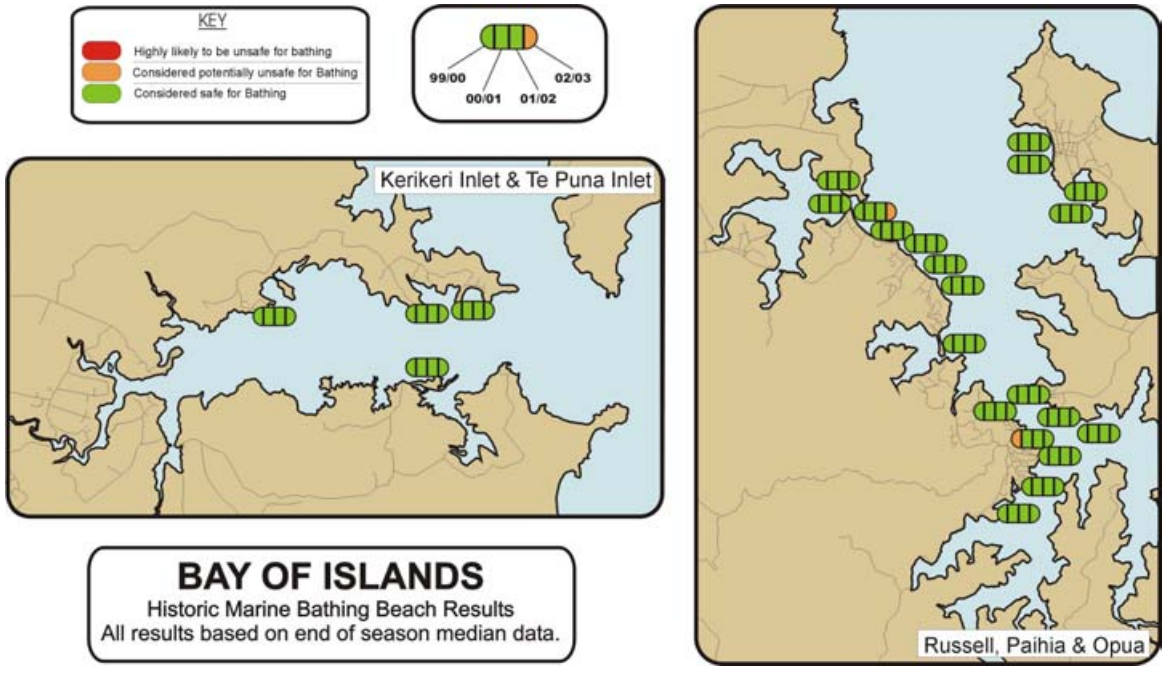

KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
Onerahi
Paru Bay
Mangenese Point
Whangarei Harbour
McLeods Bay
One Tree Point
Reotahi
Marsden Point
WHANGAREI HARBOUR COASTAL SETTLEMENTS - Eastern Side
2002/2003 Marine Bathing Beach Results
Based on single sample event.


KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
99/00
00/01
01/02
02/03
Pataua North
Pataua South
PATAUA
Historic Marine Bathing Beach Results
All results based on end of season median data.


TINOPAI
Marina
Historic Marine Bathing Beach Results
All results based on end of season median data.


PAHI & WHAKAPIRAU
WHAKAPIRAUI
PAHI
KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
00/01
01/02
02/03


KEY
Highly likely to be unsafe for bathing
Considered potentially unsafe for Bathing
Considered safe for Bathing
99/00
00/01
01/02
02/03
Matapouri Bay
MATAPOURI
Historic 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
99/00
00/01
01/02
02/03
Kerikeri Inlet & Te Puna Inlet
Russell, Paihia & Opua
BAY OF ISLANDS
Historic Marine Bathing Beach Results
All results based on end of season median data.

6.2 Antifouling Co-biocides in Northland Coastal Waters

6.2.1 Background

Antifouling co-biocides were developed in response to the regulation of tributyl-tin (TBT) after it was discovered that TBTs pose a major ecotoxicological threat to the marine environment. Copper compounds are the principle biocide in current antifoulants. Although fouling organisms such as barnacles and tubeworms are intolerant to copper, several algal species are physiologically tolerant of copper. This requires the use of organic co-biocides in conjunction with copper, including Irgarol 1051 and diuron, which are herbicides. However, there was only a limited amount of information available about the fate and toxicity of co-biocides in the marine environment when they were initially introduced.

Levels of the antifouling co-biocides Irgarol 1051 and diuron were determined in seawater and sediment samples collected from 12 key recreational boating areas around the New Zealand coast during February and March 2003. This included two sites in Northland: Tutukaka Marina and Whangarei Town Basin Marina. The report was prepared for the Ministry for the Environment.

Tutukaka marina

6.2.2 Results

Table 6.1 shows the results for the levels of Irgarol 1051 and diuron in seawater at the Tutukaka and Whangarei marinas. Irgarol 1051 concentrations were below the detection limits at all four sites. Diuron levels were elevated at all sites, especially at the Tutukaka Marina, as shown in Figure 6-1.

Table 6-1 Diuron and Irgarol 1051 at Northland sites

Location	Marina size	Tidal state during sampling	Diuron (ng L^{-1})	Irgarol 1051 (ng L^{-1})
Tutukaka Marina	228	-63	230	<5
Tutukaka Bay		-43	110	<5
Whangarei Town Basin marina	183	7	130	<5
Whangarei Estuary		54	30	<5

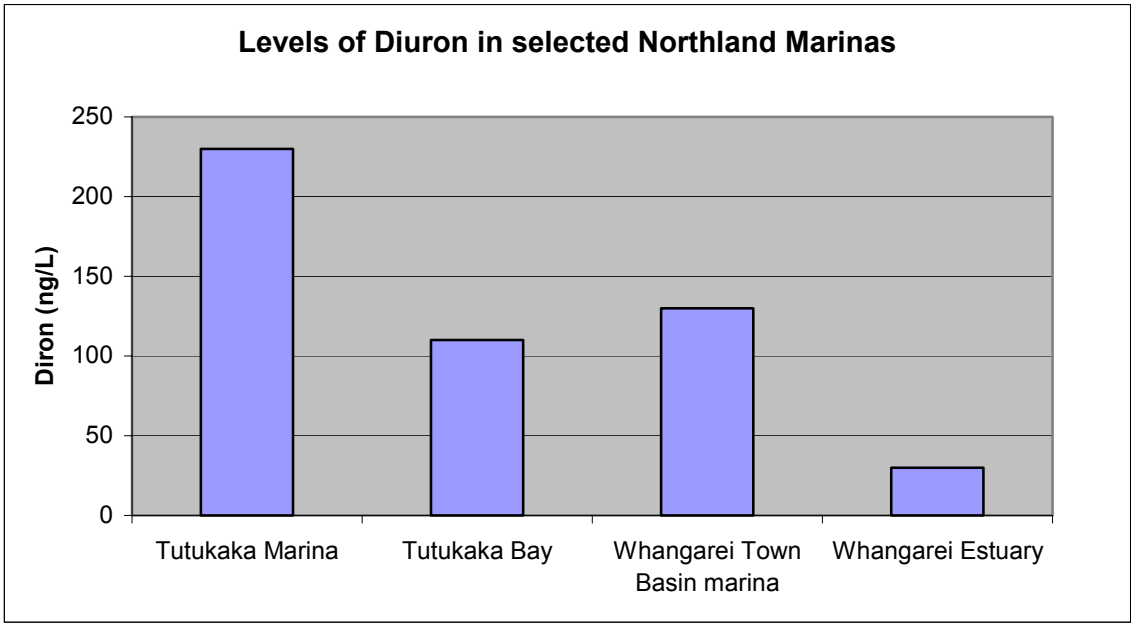


Figure 6-1 Results of the diuron and Irgarol 1051 study

Diuron was detected in 24 of the 26 sites sampled nationally. In comparison with Northland sites, the average concentration was 273 ng L^{-1}, with a maximum concentration of 830 ng L^{-1} found at the base of Waikawa marina slipway in the Marlborough Sounds. All four samples from Northland were below both the proposed NZ EEL of 1800 ng L^{-1} and the Netherlands MPC level of 430 ng L^{-1} for diuron.

Concentrations of both diuron and Irgarol 1051 were below detection limits (5 ng g^{-1}) in sediment samples collected from the Tutukaka and Whangarei Town Basin marinas. At other sites around New Zealand, where high levels of diuron and/or Irgarol 1051 were found, these tended to be near boat hull washing and repainting facilities.

From the results of this research, a number of recommendations for future monitoring in Northland have been made. These include:

- To extend water quality sampling for heavy metals at marinas to include diuron and Irgarol 1051
- To extend water quality and sediment sampling at slipways and boat maintenance facilities to include diuron and Irgarol 1051
- To introduce testing for diuron and Irgarol 1051 for SOE monitoring of sediments and detailed water analysis

6.3 Whangarei Harbour Sediment Metal Monitoring

6.3.1 Background

Heavy metal contamination of sediments can occur both naturally (i.e. weathering of rocks) and anthropogenically (i.e. industry discharges), when metals are released into the environment, settle, and become bound to sediments. Low concentrations of most metals are harmless. However, elevated concentrations of many metals can cause harm to marine ecosystems.

Monitoring of metal abundance in the sediments of the Whangarei Harbour was previously carried undertaken in 1985, 1988 and 1990. Sampling of the sediments was again undertaken in September 2002.

The main objectives of this sampling were:

- To compare sediment-metal levels with sediment quality guidelines as to assess 'toxicity' of the metals
- Assess spatial and temporal trends in metal concentrations

6.3.2 How was the sampling done?

Ten samples were collected from the 'Upper Harbour', and six from the 'Mid and Lower Harbour' (Figure 6-2) in plastic bottles using a stainless steel grab sampler operated from a boat. Three grab samples were collected from each site and combined to form a single sample to be used for analysis. Samples were analysed for total recoverable concentrations of cadmium, chromium, copper, nickel, lead and zinc.

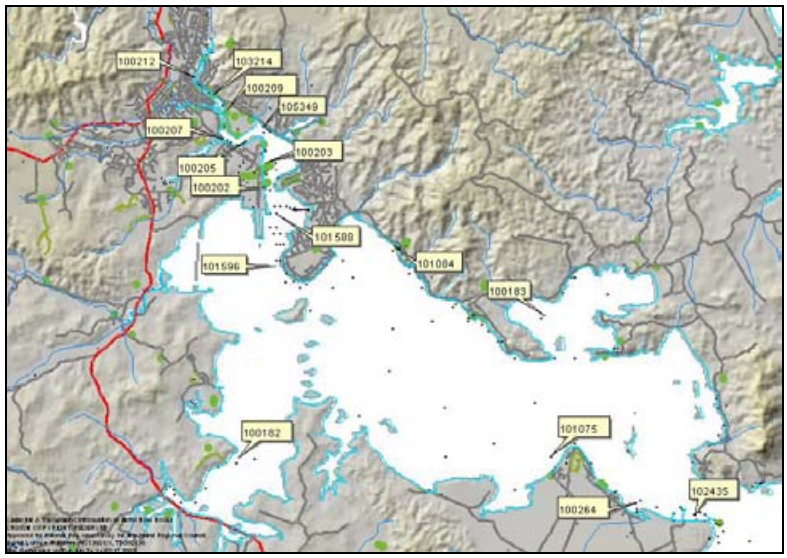


Figure 6-2 Location of sampling sites.

6.3.3 What did the results show?

- Of the metals tested, zinc was occurred in the highest concentrations, generally followed by copper, lead and chromium, nickel and cadmium (Figure 6-3).

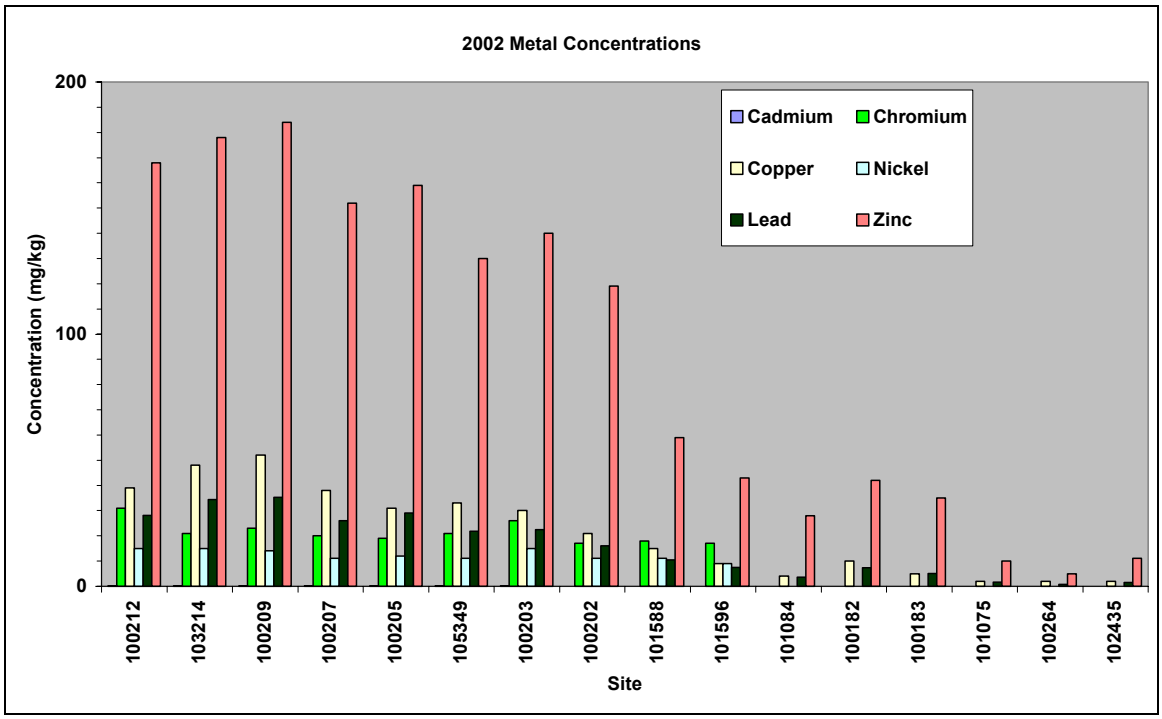


Figure 6-3 Concentrations of metals for 2002 samples.

- At all sites the metal concentrations were below 'low effect level' concentrations of the applicable marine sediment guidelines, indicating a low probability for adverse effects at the concentrations recorded.
- A number of sites in the 'Upper Harbour' area had combinations of either copper, nickel, lead and/or zinc with concentrations that were approaching the 'low effect level' concentrations of the applicable marine sediment guidelines.
- There was no strong indication of any overall increase in the concentration of metals in the sediments over time. In fact, in some cases there appeared to have been a reduction in the concentration of some metals in the 'Upper Harbour' sites from 1990 to 2002.
- A trend was evident for decreased metal concentrations with increased distance from the urbanised area of Whangarei City. This trend probably results from a combination of effects related to sediment type, supply of metals, tidal flushing and tidal mixing. The trend has been observed since the initial sampling was commenced in 1985.

6.4 Coastal Processes

6.4.1 Coastal Erosion Hazard Zone Revision

A coastal hazard is considered to arise as a result of natural phenomena such as storm surge, tsunami and other wave action, which results in either erosion, 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. CHZs enable local authorities to better plan and manage coastal development in areas susceptible to coastal hazards. Coastal hazard zones are typically incorporated into relevant district plans or a hazard register linked to the plan.

Coastal hazard zones were originally derived in several former county areas within the Northland Region in the late 1980s and early 1990s:

- Whangarei county area
- Former Mangonui county area
- Omapere-Opononi area

Since 1998, the NRC has been carrying out a review of CHZs throughout the Northland Region.

Why review coastal erosion hazard zones?

Over time, improved scientific understanding of coastal processes has resulted in changes to the methodology for the assessment of coastal hazards. Furthermore, revisions to the predicted rate of sea level rise also require the reassessment of CHZs.

Erosion of the Omapere foreshore.

How are CEHZs determined?

In determining/revising the Coastal Erosion Hazard Zones (CEHZs), the NRC uses a method developed by Dr Jeremy Gibb, which takes into account the effects of sea level rise, short and long-term fluctuations of the position of the coast, a safety factor and a number of other determinants. These factors are applied to a set of equations to derive a distance back from a known shoreline position that pertains to the coastal erosion hazard zone (An example is presented as Figure 6-4).

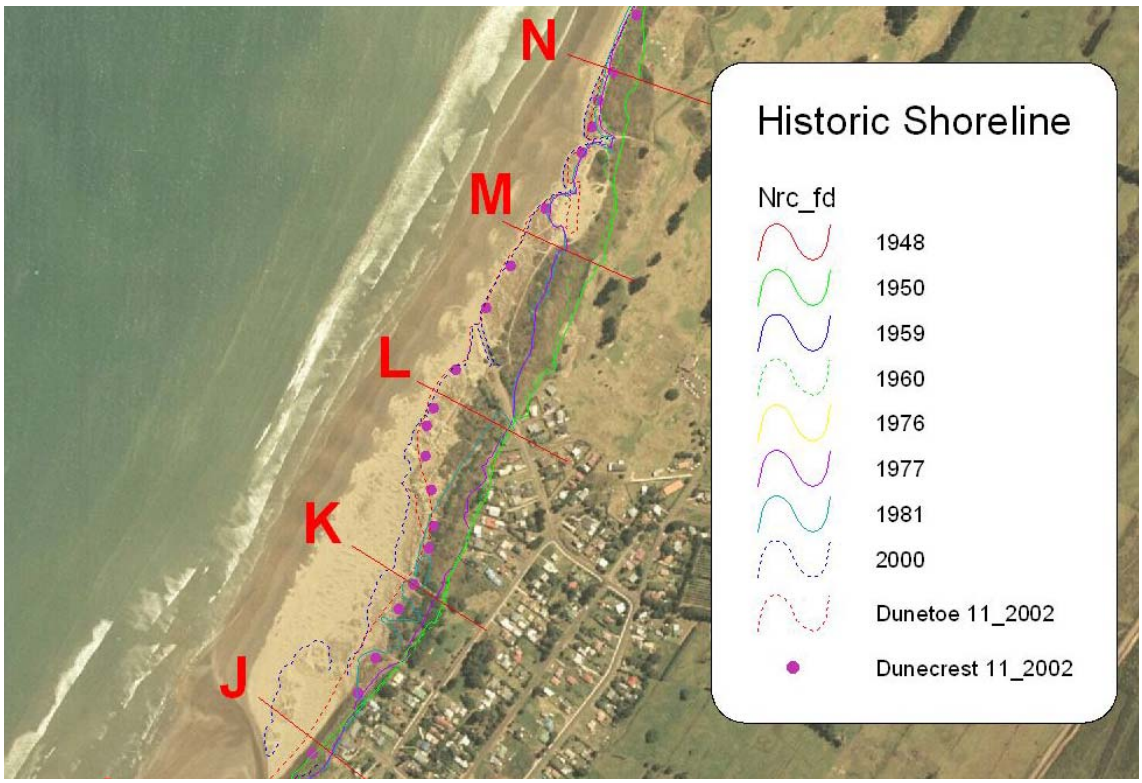


Figure 6-4 An example of some of the data used in assessing CEHZ's. These data include historic positions of the foredune toe. This example is at Ahipara.

Coastal Hazard Review 2002-03

A review of some erosion prone areas and areas that have not previously been surveyed commenced in 1999. Preliminary site investigations and fieldwork were undertaken at most sites. The areas that have been reviewed include Ahipara and Omapere. CHZ information is currently being developed for Te Ngaire Bay.

6.4.2 A Case Study: Matapouri Bay Beach Profiles

Matapouri Bay is located on the Tutukaka Coastline. Physically, it is characterised by a well-defined pocket beach, with a spit and small estuary at the southern end of the beach (Figure 6-5 & 6-6). The Matapouri settlement was built on relict foredune plains, with development encroaching well within the active coastal zone. The proximity of development to the active coastal zone puts these properties at risk from natural hazard events.

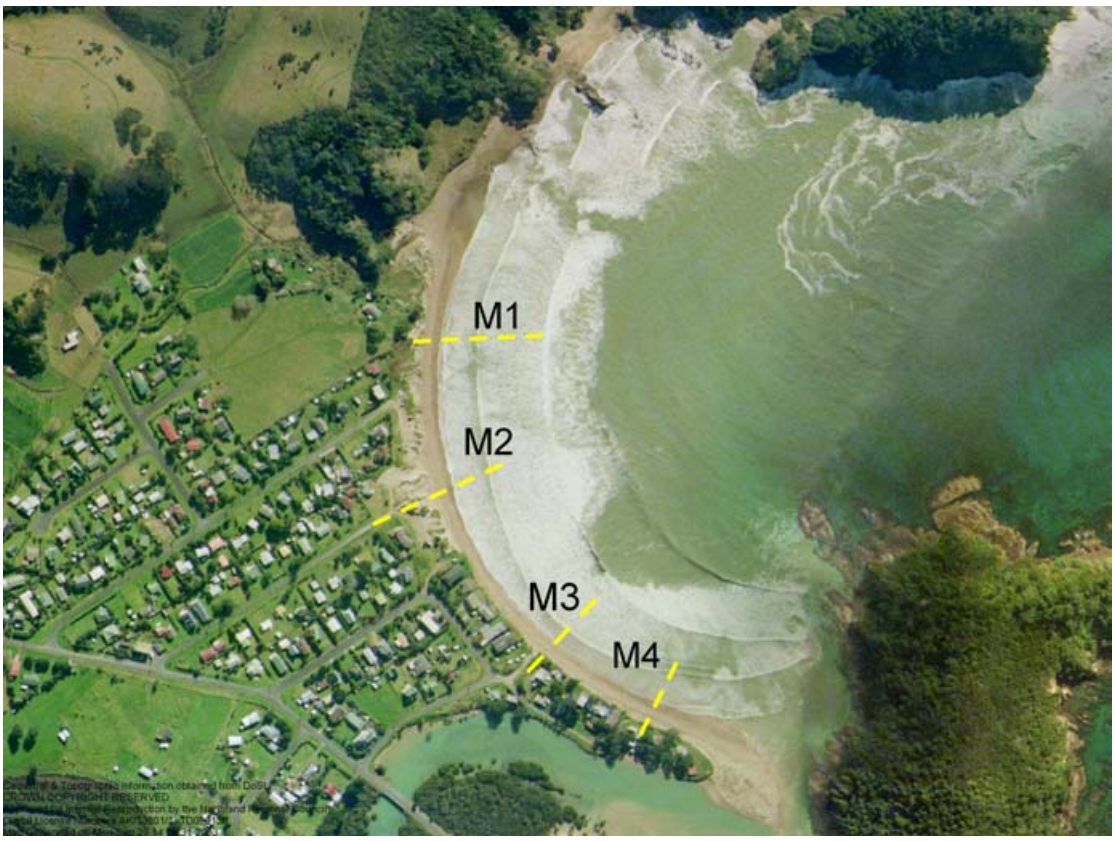


Figure 6-5 Aerial Photograph of Matapouri Bay, showing the four beach survey line locations.

Figure 6-6 Matapouri Bay, midway along beach looking south. Note location of houses on the foredune complex.

In 1988, the NRC completed Coastal Hazard Zone (CHZ) Assessments for at-risk beaches around Northland, including Matapouri. Two lines were defined, with the CHZ1 line showing the zone subject to risk from coastal hazards over a 50-year timeframe, and the CHZ2 line delineating the area expected to be at risk from rising sea level. These CHZs were reviewed in 1998.

Matapouri Bay has been in a phase of long-term retreat from coastal erosion at a rate of between –0.07 and –0.56 metres per year since 1942. Short-term duneline fluctuations ranging from 14 to 54 metres occur approximately every 20 years (Gibb, 1999). CHZ widths were calculated as follows: 30-70 metres for CHZ1; and 40-105 metres for CHZ2.

Matapouri Bay has been surveyed since 1998 to provide information on short-term fluctuations and long-term trends. Initially, only one section was used (M2), with three further sections added to from 2001 onwards. Figure 6-5 shows the location of the four sections. Due to the limited data set for sites M1, M3 and M4, the following discussion will look primarily at M2. Figure 6-7 shows the beach changes at section M2 from 1998 to 2003.

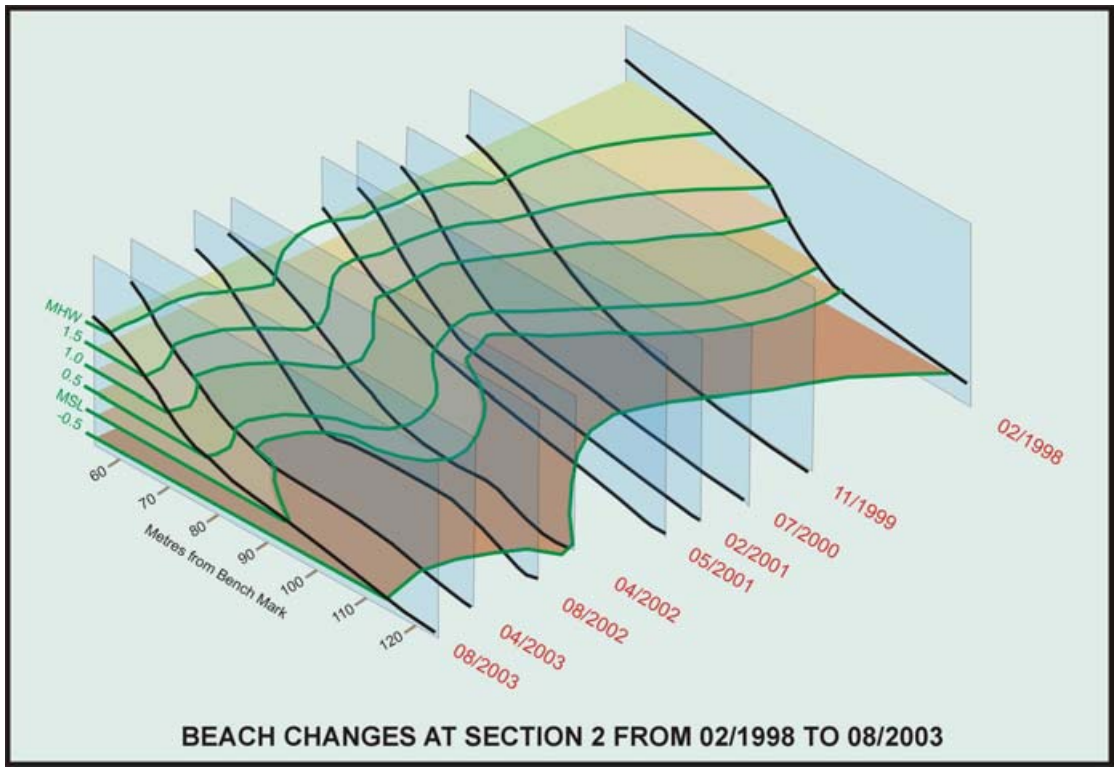


Figure 6-7 Beach changes to Matapouri section M2 from Feb 98 to August 03.

The mean high water mark at M2 eroded by approximately 10 metres between February 1998 and February 2000, with fluctuations within a five metre zone from February 2000 to date. Over the survey period, the beach is characterised by a relatively steep beach with a width ranging from 20 to 30 metres. However, there was an episode between February 2001 and April 2002 when the beach flattened off and expanded to a maximum width of approximately 50 metres. The survey undertaken on August 2002 documents the period of greatest sediment accretion, both at the mean high water mark and in the form of a distinct low tide terrace on the beachface. Following this accretionary period, the beach reverted to a profile similar to pre-February 2001 profiles by April 2003, with a narrower beach and steeper gradient.

Beaches are dynamic environments, which respond to changes on a range of time scales, from hours, in the case of a storm event, to seasons, El-Nino/La Nina cycles, and interdecal cycles. This range of temporal scales require a much larger data set then is currently recorded, if any long-term trends are to be identified from the beach profile information.

The changes to the beach profile from the current dataset reflect short-term events, particularly storm events. Matapouri was affected by one of the most severe storms in living memory on the 28th and 29th November 1998. The beach was lowered by approximately 3 to 4.5 metres, with a duneline retreat of up to 10 metres.

During July 2000, Northland experienced almost a month of continuous easterly winds at strengths of up to 35 knots, combined with the largest astronomical tides for the year. The erosion along Matapouri Bay varied, in that some areas were affected more than others, and at different times. There worst areas affected were at the northern end of the beach, where the foredune was cut back 6-7m, and at another section in the centre/spit end of the beach that also was cut back 5-6m.

6.5 Hokianga Harbour Sediment Study

Over the last 150 years, there have been large changes in the Hokianga Harbour catchment, largely brought about by deforestation and farming. Such land changes have led to marked increases in sediment runoff, and often to significant increases in sediment accumulation in the receiving (estuarine) environments, with various implications.

In February 2003, the Council studied several sub-catchments of the Hokianga Harbour to assess rates of sedimentation. The main objectives of this investigation were to quantify rates of recent sedimentation and to assess changes in nutrient concentration over time. From this, an assessment of the 'state' of the Hokianga Harbour catchment's receiving environment (in response to changes in land use) could be made.

6.5.1 How Was It Done?

Sediment cores (Figure 6-8) were extracted from the Tapuwae, Whirinaki and Utakura River catchments (Figure 6-9) with an auger. These cores were then dated (using ^{210}Pb and ^{137}Cs techniques), and analysed for concentrations of total carbon, nitrogen and phosphorous.

Figure 6-8 Sediment core.

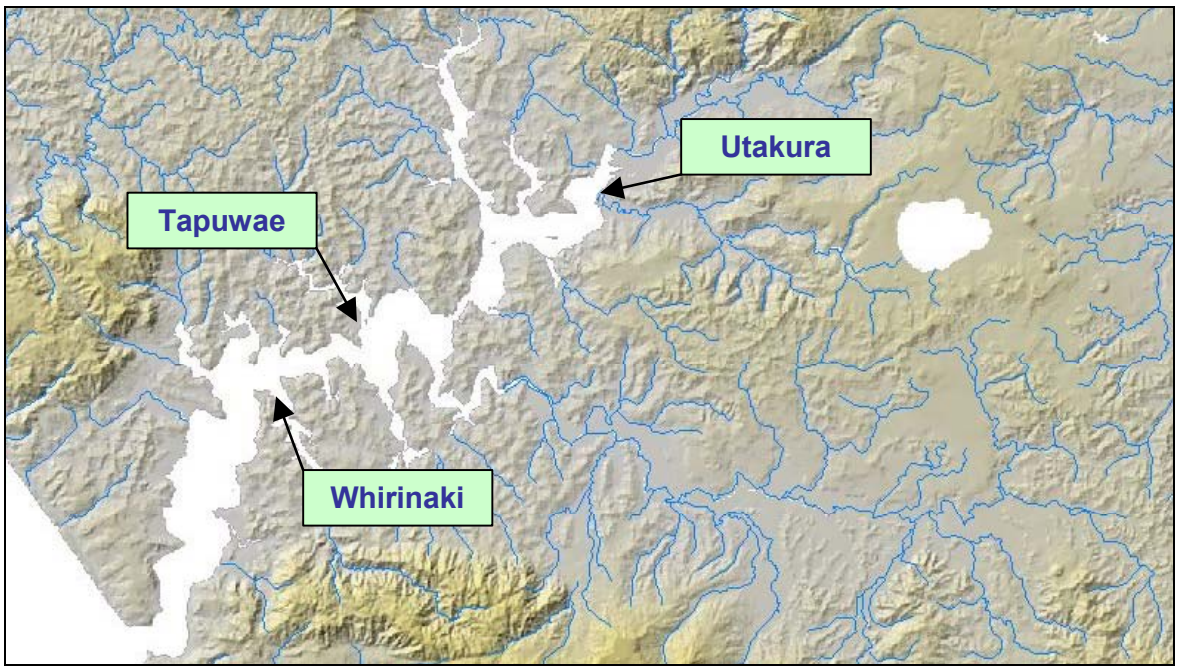
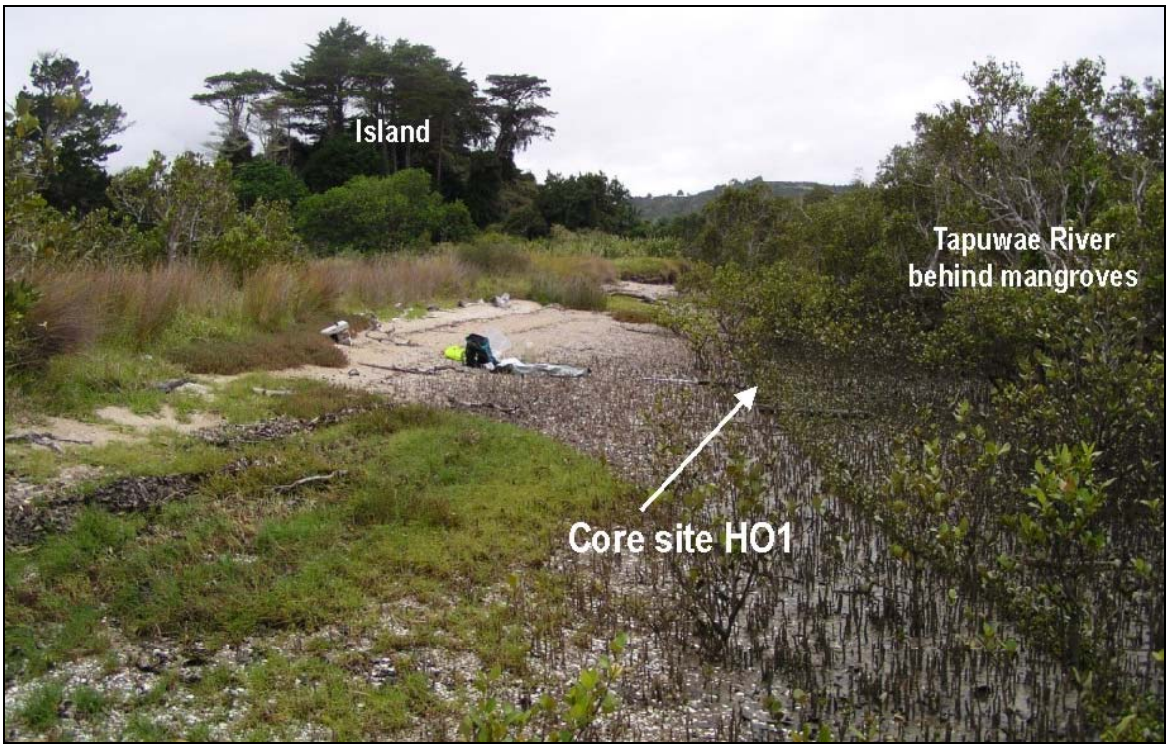


Figure 6-9 The Hokianga Harbour and the locations of catchments used in the study.



The Tapuwae River catchment sampling site.

6.5.2 What Did The Study Show?

The southern side of the Hokianga Harbour (Whirinaki catchment) had a high sediment accumulation rate in the 19th Century (4.6-6.4 mm yr^{-1}), which decreased (to 2.8-3.2 mm yr^{-1}) between 1953 and 2003. On the northern side of the Hokianga Harbour (Tapuwae catchment), a record of significantly higher sediment accumulation was recorded (between 14 & 5.6 – 6.4 mm yr^{-1}) over the corresponding periods.

The high rate in the Tapuwae catchment is indicative of the greater land clearance and development in this area in comparison to that in the Whirinaki catchment. When compared to other estuarine receiving environments, the rates recorded in the Hokianga Harbour catchment are within the typical range recorded for other sites throughout New Zealand.

In general, nutrient levels were low and, in most cases, within the parameters reported for other estuarine environments throughout New Zealand. There was a suggestion that the Utakura catchment was experiencing increasing concentrations of total carbon, nitrogen, and phosphorus. While the source cannot easily be identified, an association with Lake Omapere is a possibility.

What are the implications of these findings?

The implications are similar for many other estuarine environments throughout New Zealand that have been shown to have similar rates of sedimentation and nutrient status.

The likely implications include:

- infilling of estuaries
- increased mangrove coverage
- reduced water clarity
- reduction in the proportion of suitable habitat for the popular edible shellfish species (i.e. pipi, cockle etc) as habitat displacement occurs through smothering by fine muddy sediments.