Mimiwhangata
Marine Monitoring Programme

Summer 2005

By

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Contents **Page**

Abstract		**1**
1.	**Introduction**	**2**
2.	**Results**	**4**
	2.1 Crayfish	**4**
	2.2 Fish	**6**
	2.3 Other marine life	**8**
	2.4 Tuatuas	**9**
	2.5 Algal forests and kina	**12**
3.	**Discussion**	**14**
	3.1 Crayfish	**14**
	3.2 Fish	**16**
4.	**Recommendations**	**18**
	4.1 Analysis of existing data	**18**
	4.2 Future monitoring	**18**
5.	**Acknowledgements**	**19**
6.	**References**	**20**
Appendix 1		

Cover picture: Crayfish have been so depleted at Mimiwhangata that on the transects it is now rare to see a legal-sized cray. Small numbers of juveniles are still seen, like this lone sublegal cray on a reef north of Awash Rock. Compare this with Figure 4 on page 15, showing abundant large crayfish, sitting out in the open, at the totally protected Tawharanui Marine Park, where a policy of no-take has been observed since 1981.

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Abstract

In April and May 2005 monitoring of all ten permanent fish and crayfish transects at Mimiwhangata were again completed, following similar sampling in 2004. Red crayfish numbers had dropped even further, to the point where only two legal-sized crays were found at Awash Rock, and none on the other transects. This is the worst result for legal-sized red crayfish on record, and suggests that the red crayfish population is in serious trouble. Small numbers of sublegal red crayfish were present on some of the transects. Packhorse crays continue to be absent from all transects.

Fish populations appear to have remained relatively stable. A drop in numbers and sizes of red moki at Cockers Rock Gut and Flax Bush Bay suggest possible impacts from amateur spearfishers. After a bad year for recruitment in 2004, recently settled red moki are present again on several transects. No spotted black grouper were seen this year, though subtropical mimic blenny and a one-spot demoiselle were seen.

A new bed of juvenile tuatuas has appeared on the north end of Mimiwhangata Beach. The total population is about 1.7 million individuals, with a modal length of 10 to 15 millimetres.

Sea urchins on some transects have been affected by a toxic microalga *Ostreopsis*, which makes the kina sick and some die. A partial recovery of algal forests, particularly at Flax Bush Bay, may be a temporary result of the impact of the disease on kina.

Decadal analysis of historic crayfish data for Mimiwhangata and Tawharanui suggest that red crayfish at Mimiwhangata are heading for a crash, as happened in the open-fishing area at Tawharanui nearly 20 years ago. This contrasts with spectacular increases in red crayfish numbers and sizes in the no-take area at Tawharanui Marine Park.

1. Introduction

The Mimiwhangata Marine Monitoring Programme, established in winter of 1976, is one of the longest-running monitoring programmes of its type, and has produced a valuable long-term historical data series unique in New Zealand. It was designed to assist management of marine resources, at a time when the then owners of Mimiwhangata Station, Lion Breweries Ltd., had a vision to create a coordinated land and sea park at Mimiwhangata, as a gesture of goodwill to the people of New Zealand.

The monitoring programme focussed mainly on popular edible species of shellfish and fish, in both intertidal and subtidal areas. Tuatuas, mussels, and kina in rockpools were monitored on the shores, while reef fish, crayfish, kina and scallops were the primary focus underwater. The information gathered was to be used to carefully manage the level of recreational harvesting of these species, to foster their continued availability at a sustainable take rate in the future marine park.

Monitoring was carried out every three months for the first year, in order to establish any seasonal effects on the various species. Then monitoring was reduced to once or twice a year, mainly with sampling before and after the summer influx of visitors to assess their impacts on the marine life. Sampling became intermittent prior to 1986 when the last comprehensive survey was completed prior to a major management change which saw the Department of Conservation taking over administration of Mimiwhangata Station.

A Marine Park was established in 1984 in the waters surrounding Mimiwhangata. Special Fisheries Regulations were established, which restricted recreational fishing in terms of fishing methods and species which could be taken, with a view to allowing fishing only by methods and for species which could stand a moderate amount of fishing pressure. The intention was for all other species to be protected, as a healthy natural "background" of marine life for the non-extractive enjoyment of visitors to the Marine Park.

Commercial long-lining and potting for crayfish was allowed to continue until 1994 when it was ended, leaving limited recreational fishing as the main extractive activity at Mimiwhangata.

In 1994 it was realised that an omission in drafting of the special fisheries regulations for Mimiwhangata meant that, although species and gear restrictions were included in the regulations, all other marine life was NOT protected as intended. The regulations were effectively unenforceable and in practice many people have continued fishing in the Marine Park in accordance with normal recreational fishing regulations. So we have a Marine Park in which commercial fishing has been absent since 1994, and recreational fishing has continued with little change from normal recreational fishing practices.

Following 1986 there was a gap of fifteen years in monitoring until the winter of 2001 when intertidal sites were again monitored. A survey of most intertidal and subtidal sites, including 9 of the 10 fish and crayfish sites, was completed in summer 2002. In summer 2003, 6 of the 10 subtidal transects were surveyed.

In summer 2004 all 10 subtidal sites were resurveyed for the first time since 1986. Intertidal sampling was not carried out. Results of the 2001, 2002, 2003 and 2004 monitoring, together with a restatement of the methods used, are presented in a series of recent reports to the Department of Conservation (Grace and Kerr, 2002, 2003, 2004), which also made some brief comparisons with earlier historic data from the monitoring programme.

Recent monitoring has shown that, since creation of the Marine Park and removal of commercial fishing, there has been no significant change in fish populations, and a continued decline in crayfish at Mimiwhangata (Grace and Kerr 2002, 2003, 2004; Denny and Babcock 2002). As a result of the monitoring revelations, new habitat mapping information in deeper water offshore (Kerr and Grace 2005), as well as an evolution of Government policy with respect to marine protection objectives, moves were made in 2004 to work towards establishing a fully protected Marine Reserve at Mimiwhangata (Department of Conservation, 2004).

In April and May 2005 all subtidal transects were again monitored for crayfish and fish. Methods used are as detailed in an early report (Grace and Grace 1978) and restated in Grace and Kerr 2004. This report presents the results from the summer 2005 monitoring, and makes brief comparisons with earlier monitoring results.

A substantial bed of juvenile tuatuas has appeared on Mimiwhangata Beach. The bed was sampled extensively in May 2005 and an estimate of the total population made.

2. Results

2.1 Crayfish

Table 1 Crayfish 2002,2003,2004,2005 Number in 500 sq.m. (50x10m)
(Note: ND indicates not sampled that year)

Stn.	Locality	Red crayfish							
		Legal				Sub-legal			
		2002	2003	2004	**2005**	2002	2003	2004	**2005**
F1	**PaPoint**	0	0	0	**0**	1	0	0	**0**
F2	**Grey Rock**	0	1	0	**0**	0	0	0	**0**
F3	**Lunch Bay**	10	3	2	**0**	28	18	4	**11**
F4	**Awash Rock**	0	ND	0	**2**	1	ND	0	**15**
F5	**Cockers Rock Gut**	0	0	1	**0**	0	0	1	**0**
F6	**Porae point**	2	1	6	**0**	5	2	12	**13**
F7	**Black Beach Reef**	0	ND	0	**0**	0	ND	0	**0**
F8	**Flax Bush Bay**	0	0	0	**0**	0	0	0	**0**
F9	**Taukawau Point**	2	ND	0	**0**	31	ND	22	**14**
F10	**Suicide Cove**	ND	ND	0	**0**	ND	ND	0	**1**

Stn.	Locality	Green crayfish							
		Legal				Sub-legal			
		2002	2003	2004	**2005**	2002	2003	2004	**2005**
F1	**PaPoint**	0	0	0	**0**	0	0	0	**0**
F2	**Grey Rock**	0	0	0	**0**	0	0	0	**0**
F3	**Lunch Bay**	0	0	0	**0**	0	0	0	**0**
F4	**Awash Rock**	0	ND	0	**0**	0	ND	0	**0**
F5	**Cockers Rock Gut**	0	0	0	**0**	0	0	0	**0**
F6	**Porae point**	0	0	0	**0**	0	0	0	**0**
F7	**Black Beach Reef**	0	ND	0	**0**	0	ND	0	**0**
F8	**Flax Bush Bay**	0	0	0	**0**	0	0	0	**0**
F9	**Taukawau Point**	0	ND	0	**0**	0	ND	0	**0**
F10	**Suicide Cove**	ND	ND	0	**0**	ND	ND	0	**0**

See Table 1 for recent crayfish data.

Since monitoring began in 1976, moderate numbers of red crayfish have been seen regularly at two transects: Lunch Bay (F3) and Taukawau Point (F9). Porae Point (F6) sometimes had a few whereas other transects contained only one or two and were sometimes devoid of crayfish altogether. Our experience suggests that red crayfish populations exhibit specific site preferences. In a fished population of crayfish, as at Mimiwhangata, regularly occupied crayfish “lairs” occur in specific places, away from which only small numbers of crayfish may be found sporadically. Their presence is related strongly to topography of the rocky seabed, as well as to the level of exploitation.

All 10 transects were monitored in 2004 and 2005, but by 2005 only two legal-sized red crays occurred on the total of 10 transects. This is by far the worst record for legal-sized crays since the start of monitoring nearly 30 years ago.

At Lunch Bay where there is a very broken rocky area and a specific crevice which usually supports a number of red crayfish, total numbers were down in 2004 from the previous two years, and in 2005 no legal-sized crays appeared at all. In 2005 there was a small increase in sublegal crays from 2004. Historically this site has had large numbers of sublegal crays in the 1970's, as well as moderate numbers of legal, sometimes large, red crays.

Taukawau Point was not sampled in 2003, but the 2004 and 2005 results showed a decline from 2002 numbers. Legal crays were absent in 2004 and 2005, and sublegals showed a steady decline from 2002.

Porae Point showed a slight increase in legal crays to 2004, but in 2005 legal crays had reduced to zero. At the same time there was a slight increase in sublegal crays.

In 2005 Awash Rock was the only transect to show any legal sized crays at all, the two present being just a little over the minimum legal size limit. There were, however, more than usual sublegal crays at this site in 2005.

Pa Point, Grey Rock, Cockers Rock Gut, Black Beach Reef and Flax Bush Bay all had no red crayfish, which is consistent with low or zero counts in the monitoring history since 1976.

It is now many years since packhorse or green crayfish were seen on any of the transects. For a few years back in the 1970's, a few small specimens were often seen on the transect at Taukawau Point. Last year there were reports of a few small packhorse crays seen at Mimiwhangata, and we found two small cast shells. None were seen in 2005.

2.2 Fish

Table 2 Reef fishes 2005 survey results.

Species	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Yellow moray		1		3						
Scorpionfish (dwarf)	4				1					2
Kahawai				c.100						c.300
Goatfish	40	3	14	1	14	7	5	12	6	7
Silver drummer			5	4	7	4	1		12	
Parore	15	c.12	13	c.40	c.20	7	7	8	7	8
Blue maomao	8	3	c.40	35	20	2			46	c.22
Sweep	13	2	c.65	4	c.8	c.50	c.50		10	3
Black angelfish			9	1	12	2	14	1		
Demoiselle		c.85		c.180	c.50		16	7		
Kelpfish	c.12	c.18	c.14	6	c.13	12	c.20	8	19	7
Marblefish		1	4	1	1	1	3		4	1
Red moki	c.9	c.17	c.30	5	c.7	c.14	c.21	c.5	c.11	c.10
Porae	1									
Spotty	c.100	c.90	c.50	c.18	c.15	c.40	c.60	c.80	c.50	c.70
Orange wrasse							1			
Banded wrasse	10	8	10	c.10	5	5	16		9	4
Sandagers wrasse			1	4	1					
Red pigfish			2	2	2		3			
Butterfish	1	2	2	2	1	c.12	3	1	6	1
Leatherjacket	2	4	4	c.15	8	6	16	6	1	9
Conger eel (northern)		1								1
Rock cod	2	1				1			1	
Koheru		c.250		c.150		8			20	
Jack mackerel		c.550	c.300	c.200		c.400	c.20	7	3	c.500
Slender roughy	4	c.24			1	3		5	2	9
Bigeye		x	x	x	x	x	x	c.150	x	x
Trevally	c.33		6			c.18		1	c.110	1
Snapper	1			1	3					1
Long-snouted pipefish*						1		2		3
Eagleray			1		1				1	1
Kingfish				1						
Piper					c.200					
Oblique-swimming blenny	x	x	c.80	c.190	c.40	c.150	c.110	x	x	
Anchovy			3			c.30				
John dory	1									
Grahamichthys*		1							1	2
Plagiotremus		1	1	1			2			
Blue cod			1							
One-spot demoiselle				1						
Number of species*	18	21	23	26	23	21	19	14	20	20

Table 3 Number of Fish Species, 2002, 2003, 2004, 2005

Number in 500 sq.m. (50 x 10 metres) (ND indicates not sampled)

Station	Location	Number of fish species				Mean
		2002	2003	2004	2005	
F1	Pa Point	15	19	16	18	17.00
F2	Grey Rock	19	19	22	21	20.25
F3	Lunch Bay	20	22	18	23	20.75
F4	Awash Rock	20	ND	24	26	23.33
F5	Cockers Rock Gut	19	19	15	23	19.00
F6	Porae Point	24	20	20	21	21.25
F7	Black Beach Reef	17	ND	18	19	18.00
F8	Flax Bush Bay	14	12	12	14	13.00
F9	Taukawau Point	14	ND	16	20	16.67
F10	Suicide Cove	ND	ND	11	20*	15.50

Fish

Counts of fishes on all transects for 2005 are in Table 2. The number of fish species on each transect from 2002 to 2005 is presented in Table 3.

On most transects the number of fish species counted in 2005 is slightly higher than in the previous three years, but in general is considered to be within the normal range of fluctuation. It is often a matter of chance if a single specimen of a reef fish with low natural density happens to be on the transect during the time of the count, because in many cases the transect area covers only a part of the home range of a particular fish.

A considerable jump in species numbers occurred on the Suicide Cove (F10) transect. This transect has only been sampled about three times in the history of monitoring. It is in an area which is usually plagued by turbid waters, but this year it was clear. Most of the area of the transect is occupied by a well-developed kina barren and usually there are few fish species (11 in 2004). But in 2005 the count was accidentally continued beyond the usual 50 metres, out to 60 metres and on to a healthy forest of Ecklonia kelp. Several additional fish species occurred within the kelp forest, giving a biased result for 2005, with 20 species recorded. Unfortunately there is no way of extracting the true data comparable with previous years.

No spotted black grouper appeared on the transects this year, and none were seen in holes often occupied by them close to but not on some transects. There are several holes near or on transects at Mimiwhangata which have, over the years, been occupied by a succession of small spotted black grouper. Obviously there is something special about these small “lairs” which makes them suitable for young spotted black grouper, but there appears to be few around in 2005.

Other subtropical species have re-appeared however. The small mimic blenny *Plagiotremus tapeinosoma* disappeared in 2004 but is now present on four of the transects, with two specimens seen at Black Beach Reef. A single juvenile one-spot demoiselle, *Chromis hypselepis*, was seen at Awash Rock. These and other subtropical curios are likely to continue to appear sporadically, particularly on the outer reefs of Mimiwhangata, where they probably arrive as larvae on the East Auckland Current, derived from subtropical areas to the north and west of New Zealand. Some of them may occur here as annuals, especially the small species like the mimic blenny and one-spot demoiselle, and may not survive through the cold New Zealand winter.

After a particularly bad year for recruitment of juvenile red moki in 2004 (3 juveniles on 10 transects), 2005 was a reasonably good year with a total of about 20 juveniles seen on the 10 transects. There was a worrying change, however, of decreasing adult red moki since 2004 at Flax Bush Bay (down from 12 to 5) and Cockers Rock Gut (down from 20 to 7). Of the remaining red moki none are large. At Flax Bush Bay many of the fish now present are juveniles or relatively small adults.

Snapper continue to be rarely seen on the transects. A total of six were seen on four transects in 2005, all between 15 and 25 cm long, and under the legal size limit for fishing. It was encouraging, however, to see about 50 juvenile snapper 3 to 5 cm long off the end of the transect at Taukawau Point. Juvenile snapper have often been seen here in quantity in the early years of monitoring. In the late 1970's an area to the east of the transect was frequently occupied in late summer by an aggregation of large snapper, possibly for spawning purposes, but they have not been seen here for the last 20 years or so.

2.3 Other marine life

Table 4 Other marine life, 2005

Station	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
Species										
Centrostephanus	0	15	21	20	11	3	5	10	2	0
Charonia sp.	2	3	0	0	0	0	2	0	1	0
Octopus	1	0	0	0	0	0	0	0	0	0

The large purple-spined urchin *Centrostephanus rogersii* continues to be present in small though relatively constant numbers at some sites, particularly at those with cleaner water conditions. There is a potentially useful data set here for someone with a research interest in this species, going back to 1976.

The trumpet shell *Charonia sp.* is present in low numbers at four sites, and is expected to occur sporadically on any of the transects. It is a carnivore and eats several species of seastar, as well as occasionally kina.

A common octopus *Octopus maorum* appeared on the Pa Point transect where it had a collection of mussel shells. In 2004 one was seen on the Suicide Cove transect. Octopus can be expected occasionally on any of the transects from time to time.

2.4 Tuatuas

A dense bed of tuatuas was monitored on Mimiwhangata Beach in the late 1970’s and early 1980’s. The growth, movements, and final decline and disappearance of this bed were followed. The bed was the result of one particularly good spatfall of juveniles in the early 1970’s. Since then, up to this year, there has not been another large successful establishment of tuatuas on the beach at Mimiwhangata.

In 2004 reports were received of small tuatua appearing at the southern end of Mimiwhangata Beach. These beds were described as patchy and small. Tuatua were also reported at Waikahoa Bay where campers harvested them. Localised, temporary and patchy beds of tuatua are expected to occur from time to time as a normal pattern for this species. No formal monitoring of tuatua was undertaken in 2004.

Early in 2005 large numbers of very small tuatuas were noted at the northern end of Mimiwhangata Beach (Figs. 1 & 2). We sampled these tuatuas in May 2005. The bed runs from amongst the rocks at the north end of the beach to about 100 metres south, to a point just south of the historic tuatua transect T2.

We set up a sampling grid with 9 transects running down the beach from high water to low water, and about 10 metres apart, starting 10 metres south of T2 and going north to the rocks. Samples were taken at either 5 or 2.5m intervals down each transect, with the closer intervals within obvious denser parts of the bed. Single samples, each 0.1 sq.m. in area, were taken at each point, and the tuatuas passed over a sieve with 5mm wire mesh. Tuatuas were counted then returned to the area from which they were taken.

Densities varied, but ranged up to about 4800 tuatuas per square metre. The bed was densest near the northern part of the grid and down toward low water. A less dense concentration was present higher on the beach and toward the southern end of the sampling grid. Full data are presented in Appendix 1.

The total population of this bed was calculated to be around 1.7 million individuals. This compares to around 8 million for tuatuas of a similar size in a bed in this same area about 1976. The new bed is probably sufficiently robust to persist and develop into edible-sized tuatuas in a few years time, although there will be substantial natural mortality as the shellfish grow.

A size frequency analysis of a sample of 479 tuatuas from a dense part of the bed (transect line 3, 45 metres down the beach) was made, measuring the tuatuas at 5mm intervals. The mode (most frequent length) was 10 – 15 mm.

Table 5 Tuatua length frequency, Mimiwhangata North, May 2005.

Size range (mm)	Number	Percent of sample
25 – 30	1	0.2
20 – 25	66	13.8
15 – 20	130	27.1
10 – 15	276	57.6
5 – 10	6	1.3
Total	**479**	**100.0**

There had been reports of people collecting tuatuas at low tide near the middle of Mimiwhangata Beach, just north of the small stream outlet. We found patchy beds at low tide, too scattered to do a formal transect. We made a general collection, then found a moderately dense area where we dug a 0.1 sq.m. quadrat which produced 51 tuatuas, representing a density of 510 per sq.m. A size frequency analysis indicated the mode at 50 - 55 mm (Fig. 3).

Table 6 Tuatua length frequency, mid - Mimiwhangata Beach, May 2005.

Size range (mm)	Number	Percent of sample
55 - 60	33	26.8
50 – 55	69	56.1
45 – 50	11	8.9
40 – 45	2	1.6
35 – 40	1	0.8
30 – 35	0	0.0
25 – 30	0	0.0
20 – 25	2	1.6
15 – 20	1	0.8
10 – 15	2	1.6
5 – 10	1	0.8
0 - 5	1	0.8
Total	**123**	**99.8**

Figure 1 **A bed of small tuatuas 10 to 15 millimetres in length appeared at the north end of Mimiwhangata Beach early in 2005. The total number of tuatuas in the bed was approximately 1.7 million.**

Figure 2 **Sampling the small tuatuas on Mimiwhangata Beach, using a sieve to separate the tuatuas from the sand.**

Figure 3 **Near the middle of Mimiwhangata Beach there were small patches of larger tuatuas, mostly around 50 to 55 millimetres in length.**

2.5 Algal forests and kina

Changes in algal forests around Mimiwhangata between 1950 and 2003 have been discussed by Kerr and Grace 2005. Field observations of declining algal forests over the monitoring period from 1976 onwards are backed up by analysis of aerial photographs taken in 1950 and in 2003. Where algal forests were dense and extensive in the 1950's and into the early to mid 1970's, in several areas around Mimiwhangata these algal forests have been replaced by areas of rock dominated by pinkish coralline paint algae, grazed by populations of sea urchins or kina. These areas are called 'kina barrens' and their extent in 2003 is mapped by Kerr and Grace 2005.

The complex dynamic relationship between algal forests, the herbivorous kina, and the major predators of kina on the reef (crayfish, snapper) has been disrupted on the rocky coasts of northeastern New Zealand by the trophic cascade effect of overfishing. In the absence of natural numbers of snapper and crayfish due to fishing, the kina population increased at the expense of the kelp forests.

Changes in kina populations due to short-term disturbances such as disease, can result in shifts in community types over short time frames (Shears and Babcock, 2003), and result in temporary redevelopment of algal forests. Without the underlying cause being remedied, however, such temporary shifts towards algal dominated communities will be short-lived. Such has happened near Leigh where reduction in kina numbers due to a disease outbreak led to regrowth of *Ecklonia* kelp, only to be attacked by kina again as their population recovered (personal observation).

There is some evidence of disease outbreaks affecting kina at Mimiwhangata, with subsequent limited resurgence of algal communities. A toxic microalga called *Ostreopsis* has appeared in late summer at several locations, looking like a small brown fluffy filamentous fuzz which coats the rocks, weed, coralline turf and kina, and makes the kina sick (N. Shears, pers. comm.) The spines of the kina flatten out, and sometimes the kina loses spines and can die. Even the large dark *Centrostephanus* urchin can be affected, and they have been seen with their outer spines flattened and their upper spines raised into a narrow cone shape. Spine orientation in both species is similar to their response to severe water movement in storms (Russell, 1970).

In 2004 and 2005, toxic microalgae were seen to affect kina at several locations at Mimiwhangata, particularly at Flax Bush Bay, Suicide Cove, Lunch Bay, and Grey Rock.

Some re-establishment of algal forests had occurred in 2005 at Flax Bush Bay, where from 30 to 50 metres on the transect *Carpophyllum flexuosum* had reformed a fairly dense bed with plants commonly 0.5m high, in an area which was previously kina barren. *Ecklonia*, with stipe length of 20 – 30 cm, also covers most of the east wall and areas to the west around 20 metres along the transect, where little weed was present in previous years. About half of the kina had flattened spines and appeared sick with *Ostreopsis*.

At Suicide Cove the transect is dominated by kina barrens, with many sick kina in 2005, with flattened spines and *Ostreopsis* on the kina and rocks, especially in the shallows from zero to 20 metres along the transect. There was little evidence of algal forest regrowth, though there were a few *C. flexuosum* plants about 20cm high in some areas.

At Lunch Bay in 2005, *Ostreopsis* was common and many kina had flattened spines. *Centrostephanus* urchins also had *Ostreopsis* on their spines, which were held in the characteristic stressed orientation. *Ostreopsis* was also drifting around, and the transect line was brown with it at the end of the dive. There was no evidence of regrowth of significant algae.

At Porae Point there was a noticeable regrowth of the *Carpophyllum flexuosum* forest over the past two years, and *Ostreopsis* has been noted there.

At Awash Rock in 2005 small *C. flexuosum* plants were common on previously bare kina barrens, although the kina were healthy and there was no sign of *Ostreopsis* at the time of sampling. The sampling time followed a period of rough weather, however, which may have dispersed any *Ostreopsis* previously present.

Carpophyllum flexuosum plants on the sheltered side of Cockers Rock Gut have become more lush in the past two years, although the extensive kina barrens on the eastern side of the transect still contains large numbers of healthy kina.

3. Discussion

3.1 Crayfish

Throughout the first ten years of monitoring there was little overall change in abundance of red crayfish, apart from a substantial increase in juveniles in the first few years of the programme as a result of a particularly good year for recruitment. We watched these grow to a take-able size, but then they disappeared, not translating into an obvious increase in small but legal-sized crayfish. Probably fishing pressure on the general regional stocks of crayfish was responsible for their disappearance.

This pattern appears to have been repeated on a smaller scale over the last four years of monitoring of the Lunch Bay and Taukawau Point transects, where the moderate but decreasing numbers of juvenile crayfish from 2002 to 2004 did not translate into an increased count of take-able sized crays in 2005.

In fact take-able sized red crays have crashed to an all-time low, with only a total of two legal crays appearing this year in the combined count from all ten transects. The future for red crayfish at Mimiwhangata indeed looks bleak, without a drastic change in management of the crayfish population.

Numbers of larger sized red crayfish have continued to decline to their current poor state despite no legal commercial harvesting since 1994. It is now probable that amateur fishing is driving crayfish numbers down almost to a state of local extinction. Experience within totally protected marine areas such as the marine reserves at Goat Island, Hahei, and Gisborne, as well as the totally protected Tawharanui Marine Park, shows that under a total protection regime legal-sized red crayfish numbers increase spectacularly within five years of protection where the habitat is suitable (Kelly 1999, Kelly et.al. 2000, Hagget & Kelly 2003). It is expected that the same would happen at Mimiwhangata under total protection.

In 2004 and 2005 the authors repeated monitoring of historic transects set up at Tawharanui Marine Park and at adjacent unprotected ‘control’ sites outside the Park. These transects were set up one year after Mimiwhangata monitoring was commenced and with the same methodology (Grace, 1979). This allowed comparison between areas with ‘partial protection’ (Mimiwhangata - no commercial fishing since 1994 but continued recreational fishing), areas that have no special protection (Tawharanui ‘control’ sites – continued commercial and recreational fishing), and areas with full protection (Tawharanui Marine Park – total protection since 1981).

Results show that the Mimiwhangata counts most closely resemble those of the Tawharanui no-protection control sites, where red crayfish numbers crashed to zero within a few years of the establishment of the adjacent no-take Marine Park. The decline of crayfish at Mimiwhangata is taking a little longer, but it also started at a higher population density. There is no doubt, however, that the Mimiwhangata red crayfish population is heading for a crash.

In contrast the counts from transects within the fully protected area at Tawharanui show large increases in total numbers of red crayfish as well as an increase in larger individuals. By 1989 the trend of greater numbers and larger sizes of crayfish inside the fully protected Marine Park at Tawharanui was well established (Grace, 1989). Later work confirmed this result (Marine Environmental Research 1994; Nuthall & Russell 1996; Grace & Kerr 2004 and 2005 unpublished data). This data is being analysed further in conjunction with Dr Nick Shears from the Leigh Marine Laboratory, and is being prepared for publication, examining the multi-reserve, partial vs. full protection vs. open fishing comparison for red crayfish at Tawharanui and Mimiwhangata.

The existence of long-term data sets from Mimiwhangata and Tawharanui lends itself to an investigation of long-term trends in red crayfish. I have carried out a simple analysis based on an amalgamation of count data from each area on a decadal basis. The trends are very clear over a time period of four decades.

Although there is a gap in the 1990’s with no data for Mimiwhangata, the decline in legal-sized red crayfish is very clear, from 4.6 per transect in the 1970’s to 0.9 per transect in the 2000’s. The situation is even worse when we consider that the latest figure (2005) brings the count right down to 0.2. The proportional drop for sublegal red crays is about the same as for the legal ones.

In contrast legal red crays in the Tawharanui protected zone have rocketed up, from 0.6 per transect in the 1970’s to a staggering 29.7 per transect in the 2000’s. At the same time sublegal crays have more or less held their level or slightly increased, apart from a temporary drop in the 1980’s.

The Tawharanui non-park area, open to commercial and recreational fishing, started at a lower density of red crayfish partly because of habitat differences. By the 1990’s red crayfish had crashed to zero. Both legal sized and smaller crayfish have not been seen on any of the transects since 1983, except for two small sublegal crays which appeared on one transect in 2004.

Figure 4. Large crayfish are now abundant at Tawharanui, after 24 years of protection in a no-take Marine Park. They don't bother to hide in holes, but just sit around in the open or near small crevices.

Table 6

Long-term (decadal) trends in red crayfish at Mimiwhangata and Tawharanui
Based on counts on permanent transects 50x10m (500sq.m)

Mimiwhangata Marine Park. No commercial fishing since 1994, limited recreational fishing.

Decade	**1970's** n=8	**1980's** n=6	**1990's** n=0	**2000's** n=4
Legal	4.6	3.8	no data	0.9
Sublegal	21.0	7.4	no data	5.0
Total	25.6	11.1	no data	6.1

Tawharanui Marine Park. Total no-take since July 1981.

Decade	**1970's** n=6	**1980's** n=8	**1990's** n=3	**2000's** n=2
Legal	0.6	2.7	8.9	29.7
Sublegal	12.9	3.7	13.5	15.8
Total	13.5	6.4	22.4	45.5

Tawharanui Non-park. Open to commercial and recreational fishing.

Decade	**1970's** n=6	**1980's** n=8	**1990's** n=3	**2000's** n=2
Legal	0.2	1.1	0.0	0.0
Sublegal	3.4	1.7	0.0	0.2
Total	3.6	2.6	0.0	0.2

3.2 Fish

Since the start of monitoring in 1976, there has been no obvious trend in fish numbers detected from the counts on the fish transects. Underwater visual counts as carried out historically at Mimiwhangata are good for following the general reef fish assemblage, but are not good at assessing changes in snapper numbers because at sizes above the minimum legal size limit (270mm) snapper tend to be diver shy.

In 2002 a comparison of fish inside and outside the Marine Park was carried out using a baited underwater video technique (Denny and Babcock, 2002), which is a good method for assessing snapper. They found no difference in snapper numbers within and without the Park boundaries. The lack of any recovery of snapper at Mimiwhangata, despite the absence of commercial fishing since 1994, and some limited controls on recreational fishing, indicates that the partial protection afforded by Mimiwhangata Marine Park is ineffective as a conservation tool for this species (Denny and Babcock, 2002).

In 2005 a small increase in silver drummer, parore, blue maomao, butterfish, jack mackerel and trevally at some sites, and their appearance at more sites than before, is an encouraging sign. These species are particularly vulnerable to set nets which are banned from Mimiwhangata.

Loss of larger individuals and decrease in numbers of red moki at Flax Bush Bay and Cockers Rock Gut is consistent with amateur spearfishers impacting on this species. Full protection in a marine reserve would see fish populations in these prime recreational snorkelling areas increase over the years, and become a great asset where inexperienced snorkellers could enjoy seeing a rich variety of fish.

4. Recommendations

4.1 Analysis of existing data

Recent analysis of the long-term data sets for crayfish at Mimiwhangata and Tawharanui (Shears et. al. in prep.) has resulted in detection of some very interesting trends, which could be useful for marine reserve advocacy purposes. A parallel data set exists for reef fish, but has yet to be worked up in a serious way to see what this information can tell us. Using the data from Tawharanui as a comparison for Mimiwhangata could help to identify any differences between a partial protection arrangement as at Mimiwhangata, full protection as at Tawharanui Marine Park, and open fishing as outside Tawharanui.

Another potential for the long-term crayfish and fish data sets is to assess any correlation between fish and crayfish data with long-term changes in algal forests. Three of the transects (Pa Point, Black Beach Reef and Porae Point) have long-term aerial photo series prepared for them. With the habitat descriptive work carried out (Kerr and Grace 2004) and field notes from historic monitoring studies, there is an opportunity to examine ecological impacts of algal forest changes over time.

4.2 Future monitoring

The historic fish and crayfish monitoring data set for Mimiwhangata offers rare long-term information that will assist future studies, especially if Mimiwhangata changes to a fully protected Marine Reserve. Any comparison of the Mimiwhangata data with those from Tawharanui would offer a unique opportunity to test conclusions drawn about the impact of a no-take management regime by having monitoring ‘replicated at reserve level’.

Historic fish and crayfish monitoring at Mimiwhangata suffers from a lack of ‘control’ areas outside the Marine Park. There are also limitations to statistical analyses of the data because of a lack of spatial replication of the transects, and the non-random way in which the permanent transects are sited.

Control transects outside the current marine park, and outside possible future boundaries for a marine reserve, should be set up to establish pre-change baseline data to cover questions relating to any management change which may take place.

The historic transects were initially designed to show change by targeting areas where habitat quality and complexity was highest. In modern terminology the historic transects were stratified by habitat quality. This approach has shown itself to be useful in the comparison of crayfish data. The University of Auckland carried out a crayfish survey inside and outside the Mimiwhangata Marine Park boundaries (Usmar et.al. 2003). The randomly sited survey results reported many zeros or very low counts, whereas on the historic transects that specifically targeted “good “ crayfish habitat the counts were no longer high but sufficient to allow the time series comparison to be made. In the case of crayfish, the comparison afforded by the two methods raises interesting questions and statistical analysis challenges relating to the ‘non-random’ way crayfish use the reef habitat, especially in a heavily fished state as at Mimiwhangata. These questions have been highlighted by the approach used for the historic transects.

A strategy for the future of marine monitoring at Mimiwhangata is currently under preparation (Grace, in prep.).

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Appendix 1.

Original T2 transect: 0 position is fence post, 9m position is the top of the dune front, 10.2 m is the toe of the dune, 12.5 m is the bottom of the vegetation (sea rocket) and red leaved weed, 34 m high water today, 38 m sandy cusps

Mimiwhangata tuatua monitoring May 4-5, 2005

	Quadrat Position	Row Position	Number of tuatua	Line	Notes
Quadrat	30	0	1	1	This line 10 metres south of original T2 transect
Quadrat	35	0	1	1	
Quadrat	37.5	0	7	1	
Quadrat	40	0	6	1	
Quadrat	45	0	6	1	
Quadrat	50	0	4	1	
Quadrat	55	0	2	1	
Quadrat	60	0	1	1	
Quadrat	65	0	4	1	
Quadrat	70	0	1	1	50mm
Quadrat	36	10	7	T2	This line is original T2 transect
Quadrat	38	10	46	T2	Replicate done, used 2mm sieve, got 35 tuatuas one of which would have gone through a 5mm sieve
Quadrat	40	10	20	T2	
Quadrat	42.5	10	12	T2	
Quadrat	45	10	23	T2	
Quadrat	47	10	14	T2	
Quadrat	50	10	4	T2	
Quadrat	52	10	2	T2	
Quadrat	54	10	0	T2	
Quadrat	56	10	0	T2	
Quadrat	60	10	2	T2	
Quadrat	70	10	4	T2	
Quadrat	75	10	2	T2	
Quadrat	30	20	1	3	This line is 10 metres north of original T2
Quadrat	35	20	1	3	
Quadrat	37.5	20	7	3	
Quadrat	40	20	73	3	
Quadrat	42.5	20	221	3	
Quadrat	45	20	481	3	Retained sample & did size frequency analysis
Quadrat	47.5	20	68	3	
Quadrat	50	20	2	3	

Quadrat	55	20	0	3	
Quadrat	60	20	0	3	
Quadrat	65	20	0	3	
Quadrat	70	20	0	3	
Quadrat	75	20	1	3	50mm
Quadrat	30	30	0	4	20m north of T2
Quadrat	35	30	0	4	
Quadrat	37.5	30	5	4	
Quadrat	40	30	32	4	
Quadrat	42.5	30	84	4	
Quadrat	45	30	254	4	
Quadrat	47.5	30	175	4	
Quadrat	50	30	2	4	
Quadrat	52.5	30	0	4	
Quadrat	55	30	0	4	
Quadrat	60	30	0	4	
Quadrat	65	30	2	4	new dense bed starts 6m north of here
Quadrat	70	30	0	4	
Quadrat	30	40	0	5	Wpt 2
Quadrat	35	40	1	5	This line 30 metres north of T2
Quadrat	37.5	40	7	5	
Quadrat	40	40	12	5	
Quadrat	42.5	40	16	5	
Quadrat	45	40	2	5	
Quadrat	47.5	40	188	5	
Quadrat	50	40	1	5	
Quadrat	52.5	40	6	5	
Quadrat	55	40	357	5	
Quadrat	57.5	40	141	5	
Quadrat	60	40	46	5	
Quadrat	62.5	40	11	5	
Quadrat	65	40	30	5	
Quadrat	66	40	666	5	
Quadrat	67.5	40	8	5	
Quadrat	70	40	38	5	
Quadrat	72.5	40	7	5	
Quadrat	75	40	2	5	
Quadrat	30	50	0	6	Wpt 3
Quadrat	32.5	50	1	6	This line 40 metres north of T2
Quadrat	35	50	3	6	
Quadrat	37.5	50	11	6	
Quadrat	40	50	31	6	
Quadrat	42.5	50	15	6	
Quadrat	45	50	11	6	

Quadrat	47.5	50	2	6	
Quadrat	50	50	0	6	
Quadrat	52.5	50	1	6	
Quadrat	55	50	4	6	
Quadrat	57.5	50	184	6	
Quadrat	60	50	5	6	
Quadrat	62.5	50	10	6	
Quadrat	65	50	704	6	including 2 @ 43mm
Quadrat	67.5	50	8	6	
Quadrat	70	50	40	6	
Quadrat	72.5	50	2	6	
Quadrat	30	60	0	7	Wpt 4
Quadrat	32.5	60	0	7	This line 50m north of T2
Quadrat	35	60	5	7	
Quadrat	37.5	60	5	7	
Quadrat	40	60	22	7	
Quadrat	42.5	60	40	7	
Quadrat	45	60	12	7	
Quadrat	47.5	60	3	7	
Quadrat	50	60	3	7	
Quadrat	52.5	60	1	7	
Quadrat	55	60	0	7	
Quadrat	57.5	60	0	7	
Quadrat	60	60	1	7	
Quadrat	62.5	60	6	7	
Quadrat	65	60	0	7	
Quadrat	67.5	60	310	7	
Quadrat	70	60	59	7	
Quadrat	72.5	60	5	7	
Quadrat	75	60	0	7	
Quadrat	30	70	0	8	Wpt 5
Quadrat	32.5	70	0	8	This line 60m north of T2
Quadrat	35	70	0	8	
Quadrat	37.5	70	2	8	
Quadrat	40	70	12	8	
Quadrat	42.5	70	32	8	
Quadrat	45	70	24	8	
Quadrat	47.5	70	3	8	
Quadrat	50	70	9	8	
Quadrat	52.5	70	9	8	
Quadrat	55	70	15	8	
Quadrat	57.5	70	41	8	
Quadrat	60	70	25	8	
Quadrat	62.5	70	29	8	

Quadrat	65	70	348	8	including 2 @ 46mm
Quadrat	67.5	70	526	8	
Quadrat	70	70	7	8	
Quadrat	72.5	70	4	8	
Quadrat	75	70	0	8	
Quadrat	30	80	0	9	Wpt 6
Quadrat	32.5	80	0	9	This line 70 m north of T2
Quadrat	35	80	1	9	
Quadrat	37.5	80	1	9	
Quadrat	40	80	20	9	
Quadrat	42.5	80	24	9	
Quadrat	45	80	2	9	
Quadrat	47.5	80	1	9	
Quadrat	50	80	0	9	
Quadrat	52.5	80	0	9	
Quadrat	55	80	0	9	
Quadrat	57.5	80	1	9	
Quadrat	60	80	9	9	Wpt 8 Adense bed approx. 4m wide extends 12m to the north otherwise beach becomes rocky and tuatua thin out to low densities north of line 9
Quadrat	62.5	80	207	9	1m south of small rock
Quadrat	65	80	227	9	
Quadrat	67.5	80	267	9	2m south of large rock
Quadrat	70	80	5	9	

Total	6472.00
Avg/Quadrat	45.90
#/m2	459.00
size of bed	3888.00
Pop of bed	**1784592**

Notes	
End of beach on level = 30m	Wpt 7
toe of dune @ gate	Wpt 9
Gate	Wpt 10
Mangrove seedlings above HWM	
Avg transect length	43.2