Environment Waikato Technical Report 2006/44

Regional Estuary Monitoring Programme (REMP) Data Report: Benthic Macrofauna Communities and Sediments – July 2004 to April 2005

Southern Firth of Thames and Whaingaroa (Raglan) Harbour

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Table of Contents

Figures

Tables

Executive Summary

In April 2001 Environment Waikato initiated the Regional Estuary Monitoring Programme at five permanent monitoring sites in both the southern Firth of Thames and Whaingaroa (Raglan) Harbour. It is a long-term programme with the objective of monitoring the temporal changes in intertidal sediment characteristics and benthic macrofauna communities which may occur as a direct or indirect consequence of catchment activity and/or estuary development. This report presents the results of monitoring the sediments and a suite of 26 'indicator' taxa characteristic of the intertidal benthic communities. It is envisaged that the Regional Estuary Monitoring Programme will provide relevant information useful in setting policy and assisting with the sustainable management of estuaries in the Waikato Region.

Five permanent sites in the southern Firth of Thames and Whaingaroa Harbour were sampled in October 2004 and April 2005. Two sites from each harbour were additionally sampled in July 2004 and January 2005. Sampling the benthic macrofauna communities involved collecting 12 randomly located core samples from a permanent monitoring plot at each site. On each sampling occasion, replicate bulked sediment samples were collected for grain-size analysis, total organic carbon and total nitrogen content, with surface scrapes collected and analysed for chlorophyll-*a* and phaeophytin content. For each of the permanent monitoring sites, changes in the assemblages of monitored benthic macrofauna taxa over time were shown graphically and examined further using a suite of multivariate statistical methods.

Results from the July 2004 to April 2005 monitoring period indicate that there are distinct differences in the benthic macrofauna communities between sites in the Firth of Thames, but less so in Whaingaroa Harbour. In both the Firth of Thames and Whaingaroa Habour there were slight changes in assemblage composition over time. The most consistently common taxa found at sites in the southern Firth of Thames included the polychaetes *Aonides oxycephala,* capitellids and *Magelona dakini*; and the bivalves *Austrovenus stutchburyi, Nucula hartvigiana,* and *Paphies australis.* The exotic 'Asian date mussel', *Musculista senhousia*, was also common at most sites (except Kuranui Bay), predominantly in April 2005. For Whaingaroa Harbour, consistently common taxa included the polychaetes *Aquilaspio aucklandica, Cossura* sp. and capitellids; and the bivalves *Austrovenus stutchburyi*, *Nucula hartvigiana* and *Arthritica bifurca*.

This report presents selected sediment results from July 2004 to April 2005. More detailed results for the sediment-monitoring component of the REMP programme will be presented in an upcoming trend analysis report. The median grain size was quite consistent at all sites in both the Firth of Thames and Whaingaroa Harbour. In the Firth of Thames similar high levels of mud were found at Kaiaua and Miranda, and during previous sampling periods (from April 2001 to October 2002) Kaiaua was generally the muddiest of the monitoring sites. Sites in Whaingaroa Harbour were generally muddier than those in the Firth of Thames. In Whaingaroa, the highest amount of mud occurred at Haroto Bay, the sediment mud content at this site has been steadily increasing since October 2002.

The sediment variable or combination of variables that best explained the assemblage composition for sites in the southern Firth of Thames was the dry weight of shell-hash and the grain size fraction of 500 to 1000 µm. For Whaingaroa Harbour, the best combination of variables was the grain size fraction of 500 to 1000 µm, the proportion of mud (grain size < 62.5 µm), chlorophyll-*a* content, dry weight of shell-hash and phaeophytin content.

This report documents the data found from one year of the monitoring programme. Detailed discussion and analysis of trends or patterns of change over time in the benthic macrofaunal communities and sediment characteristics will be reported on every five years in a separate trend report series for the Regional Estuary Monitoring Programme.

It is recommended that the monitoring programme continue as outlined in Turner (2001), with a review undertaken in 2007/2008 to assess all aspects of the sampling protocol. It is strongly advised that the formal quality control assessment protocols for the sorting, identification and enumeration of benthic core samples continue to be rigorously implemented.

1 Introduction

Environment Waikato initiated the Regional Estuary Monitoring Programme in April 2001. The programme samples permanent monitoring sites in the southern Firth of Thames and Whaingaroa (Raglan) Harbour. Within the programme, sediment characteristics and benthic macrofauna communities[1] are monitored as indicators of estuarine health at five fixed locations in each estuary. It is a long-term state of the environment programme with the objective of monitoring the temporal changes in intertidal sediments and benthic macrofauna communities which may occur as a direct or indirect consequence of catchment activity and/or estuary development. The programme provides information on the ecology of the intertidal benthic macrofauna communities in these estuaries and will ultimately provide information relevant for estuary management in the Waikato Region. Details of the rationale and design of the programme are provided in Turner (2000 and 2001).

The results of the pilot study undertaken in April 2001 were presented in Turner *et al.* (2002), results from the first year of monitoring in Turner and Carter (2004), and the results from July 2002 to April 2004 in Felsing *et al.* (2006). Results of the sediment sampling up to April 2003 were reported in Gibberd and Carter (2005). This report presents the results from the monitoring programme from July 2004 to April 2005. Time series analyses to determine any trends in the data will be carried out in a separate trends report series, which will be published every five years.

The key variables measured in the Regional Estuary Monitoring Programme are:

1 Twenty-six “indicator” taxa[2] characteristic of intertidal mud / sand-flat benthic macrofauna communities, selected to represent a variety of taxonomic groups and a range of life-histories, ecological niches and feeding methods (see Hewitt *et al.* 2001).
2 Sediment physical, chemical and biological characteristics:
    - Grain-size;
    - Organic matter content;
    - Benthic micro-algal biomass (quantified by chlorophyll-*a* and phaeophytin concentration);
    - Rates of sediment deposition and erosion.

Sediment data are collected along with biological information, to provide information about the physical and chemical environment which influences biological communities.

A pilot study was carried out in April 2001, to establish a baseline for detecting changes over time in the benthic macrofauna communities and sediment characteristics (Turner *et al.*, 2002). The permanent sites are monitored at 3- or 6-monthly intervals to provide information on temporal (seasonal, annual and longer-term) and spatial patterns of variability in the intertidal sand-flat benthic communities and sediment characteristics.

The Regional Estuary Monitoring Programme is based on similar monitoring programmes designed by NIWA and undertaken by other Regional Councils (e.g. Auckland Regional Council).

[1] Benthic macrofauna communities include the variety of organisms (e.g. shellfish, crabs, polychaetes [marine worms], crustaceans) that live in or on the bottom sediments. The “macrofauna” comprises those animals which are retained by a 500 µm mesh sieve.

[2] 'Taxa' is used here to indicate that some benthic macrofauna can not reliably be identified to species level and that therefore some of the 'taxa' or monitored may include more than one species.

2 Methods

The methods are outlined in Turner (2001), Turner *et al.* (2002), Turner and Carter (2004).

2.1 Field Sites and Sampling Regime

Five permanent sites in the southern Firth of Thames (Figure 1) and five sites in Whaingaroa (Raglan) Harbour (Figure 2) are monitored. These sites are considered to be representative of the intertidal mud / sand-flats and are distributed throughout the main area of each estuary. The site codes are presented in Table 1, which also details when sampling was undertaken.

Figure 1: Location of permanent monitoring sites in the southern Firth of Thames.

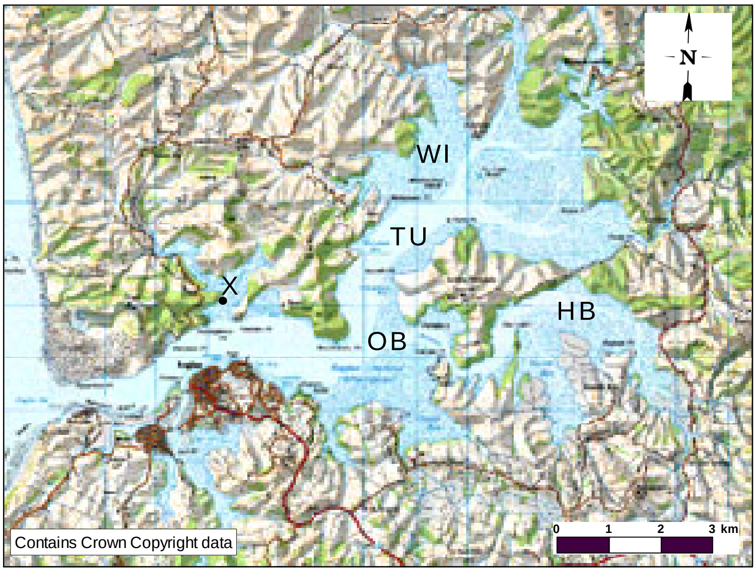

Figure 2: Location of permanent monitoring sites in Whaingaroa Harbour.

Table 1: Details of permanent monitoring sites and sampling regime in southern Firth of Thames and Whaingaroa Harbour.

Estuary	Site Name	Site Code	Sampled
Firth of Thames	Kaiaua	KA	April, October
	Miranda	MI	January, April, July, October
	Thames (Gun Club)	GC	April, October
	Kuranui Bay	KB	January, April, July, October
	Te Puru	TP	April, October
Whaingaroa	Whatitirinui Island	WI	January, April, July, October
	Te Puna Point	TU	April, October
	Okete Bay	OB	January, April, July, October
	Haroto Bay	HB	April, October
	Ponganui Creek	X	April, October

Permanent monitoring plots (approximately 100 m x 100 m) were randomly located at the mid-intertidal level at each site. Wooden posts mark the corners of each monitoring plot.

2.2 Sample Collection and Processing

2.2.1 Benthic Macrofauna

On each sampling occasion 12[3] core samples (13 cm diameter, 15 cm deep) were collected from within each monitoring plot. Each plot was divided into 12 equal-sized sectors and one core sample taken randomly (randomly derived Cartesian co-ordinates) from within each sector (see Thrush *et al.*, 1988). To minimise sample interdependence (spatial autocorrelation) samples were not positioned within a 5 m radius of each other. To preclude any effects of localised modification of sampled populations from previous sampling occasions, samples were not taken within 5 m of previous sampling positions over any 6-month period.

Macrofauna were separated from the sediment by sieving (500 µm mesh), preserved with 70% isopropyl alcohol in tap water and stained with 0.1% Rose Bengal. In the laboratory, the macrofauna were sorted, with indicator species/taxa identified and counted. Indicator bivalve species were measured (shell width) and recorded into different size-classes: *Arthritica bifurca*: < 2 mm; > 2 mm; *Austrovenus stutchburyi* (cockle): < 5 mm, > 5 mm; *Macomona liliana* (wedge shell): < 5 mm, 5-15 mm, > 15 mm; *Nucula hartvigiana* (nut-shell): < 2 mm, > 2 mm; *Paphies australis* (pipi): < 5 mm, 5-15 mm, > 15 mm; *Theora lubrica*: < 5 mm, > 5 mm. The remaining species (i.e. non-indicator species) were classified into major taxonomic groups and counted. Samples were stored in 50% isopropyl alcohol.

From each site where sufficient numbers of shellfish were available, 20 to 30 adult-sized individuals of *Austrovenus stutchburyi*, *Macomona liliana*, and *Paphies australis* were selected, frozen and retained for condition analysis.[4] Condition analysis work is currently in progress on samples dating back to April 2001.

After sorting, the remaining non-living material (e.g. broken shells – 'shell-hash') was dried at 70°C for 48 hours and weighed to dry weight.

2.2.2 Sediment Characteristics

At each site, sediment samples were collected from within the monitoring plot for the analysis of physical and chemical sediment characteristics. Grain-size, organic matter content and photosynthetic pigment concentration, are known to influence the distribution and abundance of benthic macrofauna.

[3] See Hewitt *et al.* (2001) and Turner (2001) for justification.
[4] Bivalves for condition analysis were removed during sieving and prior to sample preservation in isopropyl alcohol.

2.2.2.1 Surficial Sediment Grain-Size

Five replicate bulked surface sediment samples were collected from each monitoring plot on each sampling occasion for grain-size analysis. Samples were stored frozen. Prior to analyses, samples were pre-treated with 10% hydrogen peroxide to remove organic material and 1*M* HCl to remove carbonate material. Calgon was added as a dispersant and samples were placed in an ultrasonic bath for 10 minutes to aid disaggregation. Samples were then analysed using a Galai laser sediment analyser.

2.2.2.2 Sediment Organic Matter Content

A sub-sample from each bulked sediment sample was analysed for total organic carbon and total nitrogen content using an automated CHN analyser. Samples were dried and finely ground before analysis. Sediment for total organic carbon analysis was pre-treated with acid to remove carbonate material prior to analysis.

2.2.2.3 Sediment Photosynthetic Pigment Concentration

Five replicate surface sediment scrapes were collected from each monitoring plot on each sampling occasion. Samples were stored in black containers and frozen until analysis. Sediments were analysed for chlorophyll-*a* and phaeophytin content. Chlorophyll-*a* was extracted from the sediment by boiling in 95% ethanol and the extract analysed using a spectrophotometer. Acidification was used to separate plant degradation products (phaeophytin) from chlorophyll-*a*.

2.2.3 Southern Firth of Thames Bed Level

As part of the REMP, fluctuations in bed levels were also measured at monitoring sites in the Firth of Thames. Concrete plates have been buried across a transect at each monitoring site. The depth of sediment on top of the plates was measured to detect changes in the bed level. A pilot study to test the method was undertaken in 2003, and is presented in full in Collins (2003).

Sediment level measurements have been taken monthly since March 2003 at four sites in the Firth of Thames (Kuranui Bay, Gun Club, Miranda and Kaiaua). This report summarises the data for the sampling to date, and provides a summary of sediment level data collected monthly between March 2003 and April 2005. Recommendations are also included covering the future continuation of this part of the programme.

The monitoring technique for sediment elevation measurements is described fully in Collins (2003). Concrete tiles (300 mm x 300 mm x 40 mm) were buried to depth of approximately 200 mm. Plates were buried at approximately 50 m spacing on a cross-shore transect, extending 100 m landward and seaward of the benthic monitoring site. Plates are numbered from the most landward (1) to the most seaward (6). The location of each buried plate has been accurately surveyed and is routinely located by small wooden marker pegs. Knitting needles were used to locate the plate surface. Shell material between the needle and the plate can cause an inaccurate reading, so a number of needles of equal length were placed in the sediment to check that the measured surface is flat. Ten measurements were taken from each plate at each sampling date.

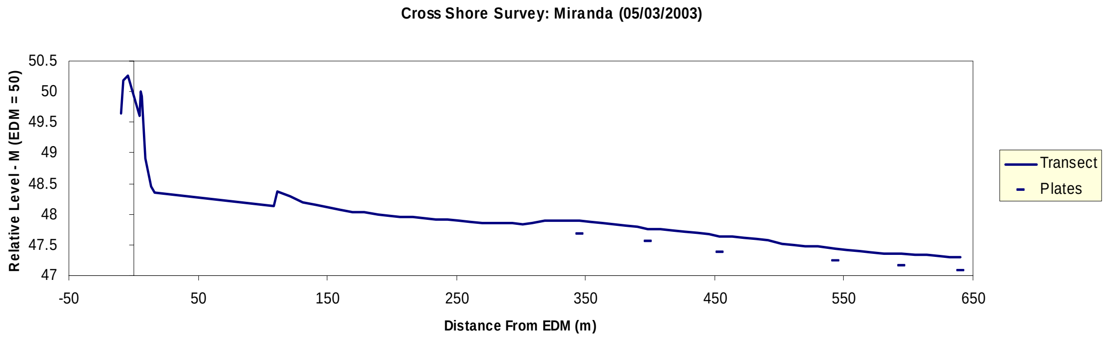

Figure 3: Typical cross-shore transect and plate locations for a sampling site in the Firth of Thames (Miranda).

2.3 Statistical Analysis

Changes in the assemblages of indicator benthic macrofauna species/taxa over time at each of the permanent monitoring sites were examined using multivariate statistical methods (PRIMER v6; PRIMER-E Ltd. Plymouth 2005). Non-metric multidimensional scaling (MDS) ordinations based on Bray-Curtis similarities of taxa abundance data provides a visualisation of assemblage composition in a two-dimensional plot. In non-metric MDS, an ordination is constructed of the mean taxa abundances on different sampling dates at each of the sites. In this ordination, sample points are mapped in a specified number of dimensions (in this case two) in such a way that the rank order of the distances between sample points in the ordination reflects the rank order of the corresponding (dis)similarities in the similarity matrix (Clarke and Warwick, 2001). The stress value is a measure of how accurately the ordination preserves the between-sample point relationships in low-dimensional space, with low values indicating a good ordination with no indication that a misleading interpretation has been achieved. Plots of the MDS ordinations of the different sites on different sampling dates allow identification of trends or other patterns of change in the assemblages of indicator taxa benthic macrofauna.

Significance testing for differences in assemblage composition between different sampling dates at each of the sites was undertaken using one-way analysis of similarities randomisation tests based on rank similarities of the samples (PRIMER ANOSIM routine [Analysis of Similarities]). This procedure tests the statistical significance of differences between groups of samples based on the composition of their benthic macrofauna assemblages. The null hypothesis is that there are no differences in assemblage composition on different sampling dates. The ANOSIM global test was used to indicate whether there were significant differences between any of the sampling dates at each site. The global *R* value gives an indication of the extent of any differences, where values range between 0 (indistinguishable) and 1 (well separated).[5] The significant differences at each site were explored further using ANOSIM pairwise comparison tests. These tests followed on from the global test if significant differences were found to exist, and show specifically which sampling dates were significantly different from each other as well as the extent of any differences.[6] For each of these comparisons (Date 1 vs. Date 2, Date 1 vs. Date 3, Date 2 vs. Date 3 etc.) the test statistic *(R)* is generated, which indicates the relative similarity of the assemblages between the two sampling dates that are being compared. Note that the nominal levels of Type I error (α = 0.05, i.e. the error rates per comparison) of these comparisons were not corrected to maintain the error rate per site (i.e. the probability that there will be an error in any of all comparisons) at 0.05. Such procedures would

[5] *R* values can be interpreted as follows; *R* > 0.75 = well separated, R > 0.5 = overlapping but clearly different, R < 0.25 barely separable (Clarke and Gorley, 2001).

[6] The important message from the ANOSIM pair-wise tests is usually not so much the significance level, but the pair-wise *R* values, since this gives an absolute measure of how separated the groups are (Clarke and Gorley, 2001).

have required the nominal level to be set at α = 0.017 for three tests and α = 0.005 for 10 tests and would have increased the risk of Type II errors in each comparison.

Other statistical tests used include the PRIMER SIMPER ("similarity percentages") and BVSTEP routines. SIMPER was used to examine the contribution of each indicator taxa to the average Bray-Curtis dissimilarity between two sampling dates. Here, species with high average contributions relative to the standard deviation are considered to be important in the differentiation of assemblages on the different sampling dates. BVSTEP was used to identify the smallest subset of indicator taxa which explain most of the pattern observed in the full set of taxa. This is (somewhat arbitrarily) taken to be when the Bray-Curtis similarity matrix of the subset of taxa correlates to at least $\rho \geq 0.95$ with the similarity matrix of the full set of taxa. BVSTEP differs from SIMPER analysis in that it considers all the data from all the sampling dates at once rather than comparing pairs of samples.

A square-root transformation was applied to the data to reduce the influence that dominant taxa have on the results. Because only a sub-set of the taxa in the communities have been monitored, the dominance of taxa in the sub-set does not necessarily reflect their true dominance in the whole community, so it is appropriate to reduce their influence on the analysis (Morrisey *et al.*, 1999). The MDS ordination was based on the mean abundance values for each indicator taxa from all the samples at each site on each sampling date. ANOSIM, SIMPER and BVSTEP analyses used the indicator taxa data from each replicate sample collected at each site on each sampling date. The number of individuals of each indicator bivalve species in all the size-classes combined was used in all analyses.

The BIO-ENV routine in PRIMER was used to discern the relationship between multivariate assemblage composition and sediment variables. Where sediment variables were highly correlated, only one variable was included. The analyses used the mean abundance values for each indicator taxa from all the samples at each site on each sampling date and the mean values for sediment variables. Certain sediment variables were log transformed as the BIO-ENV routine requires that environmental variables not show marked skewness across the samples.

For the Firth of Thames the following sediment variables were included in the BIO-ENV analysis: grain size fractions of < 62.5 µm (% mud); 62.5 to 130 µm; 130 to 250 µm; 250 to 500 µm; 500 to 1000 µm; >1000 µm; median grain-size, dry weight of shell-hash; total nitrogen and total organic carbon content; chlorophyll-*a* and phaeophytin concentrations. Of these, the median grain-size and the shell-hash content were log-transformed prior to analysis. For Whaingaroa (Raglan) Harbour, the following sediment variables were included in the BIO-ENV analysis: < 62.5 µm (% mud); 62.5 to 130 µm; 130 to 250 µm; 250 to 500 µm; 500 to 1000 µm; >1000 µm; median grain-size, dry weight of shell-hash; total nitrogen and total organic carbon content; chlorophyll-*a* and phaeophytin concentrations. None of these were log-transformed.

The BIO-ENV routine identifies the subsets of the environmental variables which yield the best matches between biological (species abundances) and abiotic (sediment variables) (dis)similarity matrices, as measured by Spearman rank correlation (ρ_s). It is important to note that linking patterns in the benthic macrofauna assemblages to those of sediment variables provides only an indication of which sediment characteristics may be important in contributing to the biological pattern, they do not actually prove cause-and-effect. Causality can only be demonstrated by manipulative field or laboratory experiments (Clarke and Warwick, 2001).

3 Results

3.1 Benthic Macrofauna Community Structure

3.1.1 Southern Firth of Thames

Figure 4 shows the mean total number of individuals and the major taxonomic group composition of the intertidal benthic macrofauna communities at each of the permanent monitoring sites in the Firth of Thames on each sampling date between July 2004 and April 2005. At TP and KA bivalves were found to be the most abundant taxonomic group, whereas polychaetes were the most abundant group on most sampling dates at GC, MI and KB.

Between July 2004 and April 2005, sites GC and KA showed the greatest changes in the total number of individuals and taxonomic composition. At sites TP, MI and KB the total number of individuals and taxonomic composition was relatively consistent between sampling dates. Bivalves were the most abundant taxonomic group at KA on both sampling dates (59-66% of total abundance). In April 2005 there was a significant increase in the total number of individuals and the abundance of both indicator (in particular *Austrovenus stutchburyi*) and non-indicator (in particular the exotic 'Asian date mussel', *Musculista senhousia*) bivalves. The benthic community at TP was also dominated by bivalves (68-78% of total individuals) on both sampling dates, and showed a small increase in total number of individuals in April 2005

At GC an increase in total number of individuals occurred from October 2004 to April 2005. This was mainly due to an increase in number of polychaetes (i.e. *Aonides oxycephala*), and the Asian date mussel and other non-indicator taxa in April 2005. Polychaetes were the most abundant group on both sampling dates (~70% of individuals).

Over all sampling dates at MI and KB there was no great variation or trend in the total number of individuals and taxonomic composition. The community at MI in July 2004, October 2004 and January 2005 was dominated by polychaetes (51-70% of individuals). In April 2005 the site showed similar abundances of bivalves and polychaetes. At KB there were similar abundances of bivalves and polychaetes in July 2004, with polychaetes dominating in October 2004 (70%) and January 2005 (66%), and bivalves slightly higher in abundance in April 2005 (54%). MI and KB had the lowest number of total individuals compared to the other sampling sites.

The abundances of gastropods and crustaceans in the Firth of Thames were very low.

The data are included in full in Appendix 1.

3.1.2 Whaingaroa (Raglan) Harbour

Figure 5 shows the mean total number of individuals and the major taxonomic group composition of the intertidal benthic macrofauna communities at each of the permanent monitoring sites in Whaingaroa (Raglan) Harbour on each sampling date between July 2004 and April 2005.

From July 2004 to April 2005 the total number of individuals varied at X and WI, whereas TU, HB and OB showed little variation. Taxonomic composition was relatively consistent at all sites.

Polychaetes clearly dominated numerically at site OB (68-77% of individuals), whereas bivalves were more abundant at WI (44-49%), X (52-54%) and TU (62-66%). HB had a similar abundance of bivalves and polychaetes. At site X there was a drop in total abundance from 190 individuals in October 2004 to 93 in April 2005, which was mainly due to a decrease in the abundance of non-indicator taxa and bivalves (mainly *Austrovenus stutchburyi*).

The total abundance at WI increased from 160 individuals in July 2004 to 260 in October 2004, followed by a decrease in January 2005 (225) and April 2005 (164). This was mainly caused by changes in abundance of bivalves, polychaetes and non-indicator taxa. At OB the total abundance increased from 63 individuals in July 2004 to 90–103 on following sampling dates, mainly caused by an initial increase in the abundance of polychaetes.

Gastropods at sites TU (12-15%) and WI (12-18%), and crustaceans at OB (9-14%), were relatively abundant in Raglan Harbour.

The data are included in full in Appendix 2.

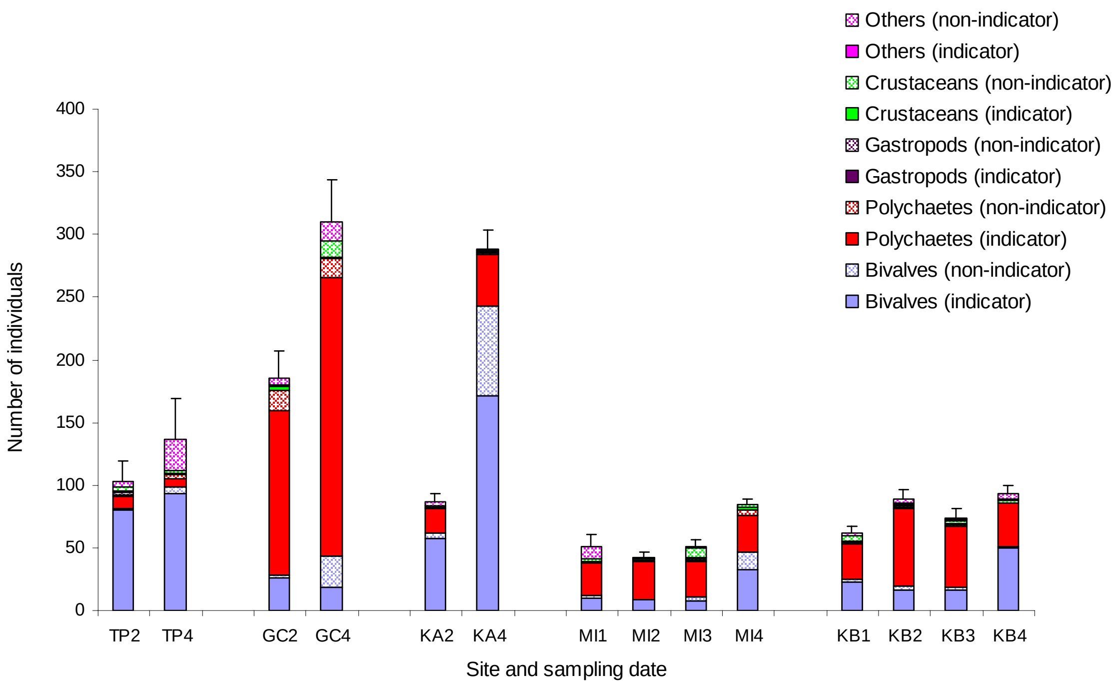

Figure 4: **Mean (± standard error) total number of individuals and major taxonomic group composition of intertidal benthic macrofauna communities at the permanent monitoring sites in the southern Firth of Thames between July 2004 and April 2005. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4.**

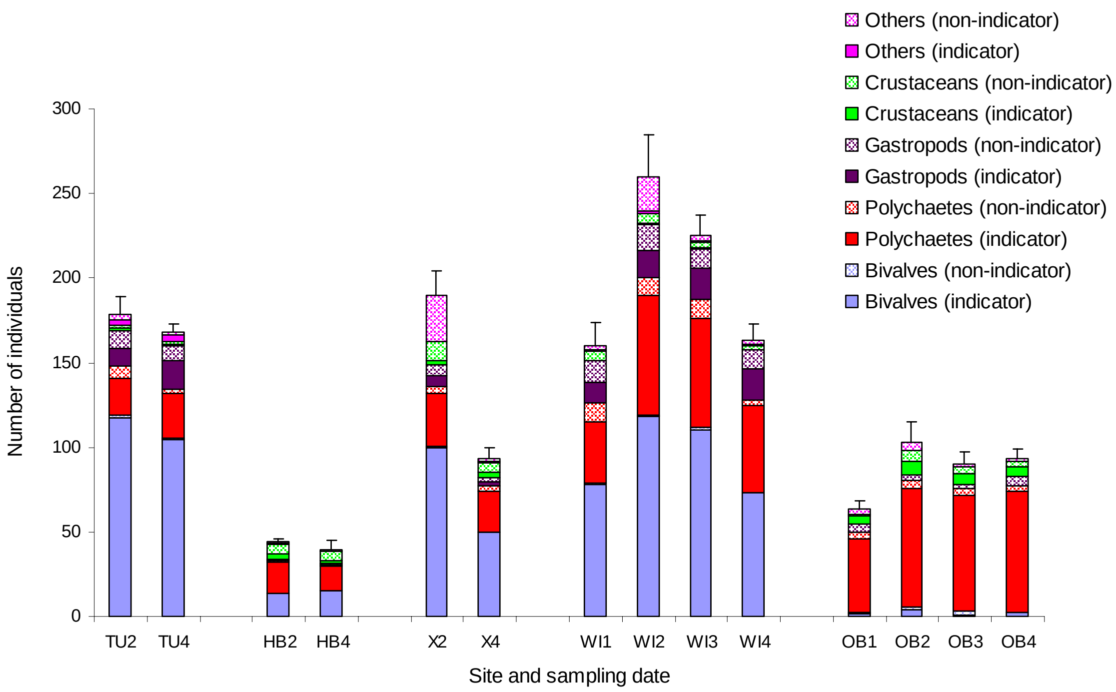

Figure 5: **Mean (± standard error) total number of individuals and major taxonomic group composition of intertidal benthic macrofauna communities at the permanent monitoring sites in Whaingaroa Harbour between July 2004 and April 2005. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4.**

3.2 Changes in the Abundance of Individual Species and Taxonomic groups

3.2.1 Southern Firth of Thames

The five most common species/taxonomic groups (indicator and non-indicator) at each of the permanent monitoring sites in the southern Firth of Thames on each sampling date between July 2004 and April 2005 are listed in Table 2.

Table 2: The five most common species/taxonomic groups on each sampling date for each permanent monitoring site in the southern Firth of Thames. 'Misc. Other', 'Other polychaetes', 'Other bivalves', and 'Other amphipods' denote non-indicator species of these taxonomic groups.

	TP	GC	KA	MI	KB
Jul-04				*Aonides*	*Austrovenus*
				Misc. Other	Capitellidae
				Austrovenus	*Magelona*
				Macamona	*Aonides*
				Other bivalves	*Macamona*
Oct-04	*Nucula*	*Aonides*	*Nucula*	*Aonides*	Capitellidae
	Paphies	*Paphies*	Capitellidae	*Arthritica*	*Aonides*
	Pseudopolydora	Other polychaetes	*Macamona*	*Orbinia*	*Austrovenus*
	Misc. Other	*Colurostylis*	Other bivalves	*Austrovenus*	*Magelona*
	Ostracods	Other bivalves	Misc. Other	Capitellidae	*Macamona*
Jan-05				*Aonides*	Capitellidae
				Other amphipods	*Aonides*
				Arthritica	*Magelona*
				Orbinia	*Austrovenus*
				Other bivalves	*Arthritica*
Apr-05	*Nucula*	*Aonides*	*Nucula*	*Austrovenus*	*Austrovenus*
	Paphies	Other bivalves	Other bivalves	*Aonides*	*Aonides*
	Misc. Other	Other polychaetes	*Austrovenus*	Other bivalves	Capitellidae
	Austrovenus	Misc. Other	Capitellidae	Nereidae	*Magelona*
	Other bivalves	Isopods	*Magelona*	Other polychaetes	*Arthritica*

From October 2004 to April 2005 only few changes were observed in the mean abundance of the most common taxonomic groups at TP, GC and KA. At TP the bivalve species *Nucula hartvigiana* (11-83 individuals core^{-1}) and *Paphies australis* (2-264 individuals core^{-1}) were the two most abundant species on both sampling dates. Misc. other (mainly nematodes, 0-85 individuals core^{-1}) were also common. At GC, the polychaete *Aonides oxycephala* was the most abundant taxa on both sampling dates (23-293 individuals core^{-1}). Although *P. australis* was the second most abundant taxa in October 2004 (7-73 individuals core^{-1}), this species of bivalve was not among the top 5 common taxa in April 2005. Non-indicator polychaetes (mainly an orbinid species) and non-indicator bivalves (mainly the Asian date mussel) were also common at GC on both sampling dates.

N. hartvigiana was the most common taxa (33-122 individuals core^{-1}) at KA on both sampling dates. In October 2004 capitellid polychaetes were the second most abundant taxa (2-45 individuals core^{-1}), whereas non-indicator bivalves (mainly the Asian date mussel) were second highest in abundance in April 2005 (19-179 individuals core^{-1}). At MI the polychaete *A. oxycephala* was the most abundant taxa (1-59 individuals core^{-1}) on all sampling dates, except in April 05, when the bivalve *Austrovenus stutchburyi* was the most abundant (13-34 individuals core^{-1}). The bivalve, *Arthritica bifurca,* and non-indicator bivalves were also common. At KB, *A. stutchburyi* was the most abundant taxa in July 2004 and April 2005 (2-71 individuals core^{-1}), and capitellids dominated in October 2004 and January 2005 (9-49 individuals core^{-1}). The polychaete *Magelona dakini* was consistently common on all sampling dates at KB (0-19 individuals core^{-1}).

Mean abundances of selected indicator species/taxa at each of the sites on each sampling date are shown in Figure 6.

The bivalve*, Arthritica bifurca* was most abundant at KB, except in January 2005 where they were more abundant at MI (Figure 6a). At KB there was a slight decrease in mean abundance in October 2004, followed by a substantial increase in numbers in January 2005, which was maintained in April 2005. The majority of *A. bifurca* recorded were less than 2 mm long. In April 2005 *Austrovenus stutchburyi* showed a marked increase in abundance from previous monitoring events at KA, KB and MI (Figure 6b). This was a reflection of the increase of individuals <5 mm. The abundance of the bivalve *Macomona liliana* was highest at MI, KA and KB, whereas numbers were low at TP and GC (Figure 6c). At KA there was a decline in mean abundance between October 2004 and April 2005, whereas at MI there was an increase in April 2005, after declining numbers in October 2004 and January 2005. Abundance of *M. liliana* at KB remained relatively consistent over the last two sampling dates after an initial decline in January, 2005. The patterns in abundance of *M. liliana* can be mainly attributed to changes in abundance of individuals <5 mm.

Nucula hartvigiana was present in high numbers at KA and TP (Figure 6d). At KA there was a substantial increase in numbers from a mean abundance of 49 individuals in October 2004 to 99 individuals in April 2005. This was due to an increase in both <2 mm and >2 mm size classes. At TP the abundance remained very consistent over the two sampling dates. Very low abundances of *N. hartvigiana* were found at GC, KB and MI. *Paphies australis* was only found in high abundances at TP and GC, with few or no individuals being found at KA, MI or KB (Figure 6e). AT TP the numbers remained consistent over the one year of monitoring. A mix of both <5 mm and >20 mm size classes were found. This is in contrast to the previous two years of monitoring where mainly >20 mm individuals were found (Felsing *et al.* 2006). At GC there was a decline in the abundance of *P. australis* (both <5 mm and >20 mm)*,* after a substantial increase in April 2004 (Felsing *et al.* 2006). In April 2005 at MI and KA there was an increase in abundance of the bivalve *Theora lubrica* (Figure 6f)*,* due to an influx of juveniles (< 5 mm).

The highest abundance of the cumacean *Colurostylis lemurum* occurred at GC in October 2004, however a sharp decline followed in April 2005 (Figure 6g). The abundance at all other sites was generally low with a peak in numbers in April 2005 at MI.

The abundance of most polychaetes species varied over the year of monitoring reported here. The most abundant polychaete was *Aonides oxycephala* (Figure 6i). This species was clearly most abundant at GC, where there was a marked increase in numbers between October 2004 and April 2005. MI and KB had consistently lower numbers. Capitellid polychaetes were also found in high numbers, with the highest abundance occurring at KA and KB (Figure 6k). At KB an initial increase in abundance between July and October 2004 was followed by a sharp decline over subsequent sampling periods. In contrast, numbers increased at KA. Another spionid polychaete species, *Aquilaspio aucklandica*, was found in lower numbers (Figure 6h). *A. aucklandica* numbers increased between July 2004 and January 2005 at KB, with a slight decline in April 2005. At MI there was a sharp increase in abundance between October 2004 and January 2005, followed by a sharp decline between January and April 2005. The abundance at KA was consistently low.

The polydorid polychaetes ("pseudopolydora complex") were most abundant at TP in October 2004, however numbers had declined substantially by April 2005 (Figure 6j). This species was found in low numbers at all other sites. *Magelona dakini* was most abundant at KB, where numbers increased slightly between July and October 2004, followed by a gradual decline on subsequent sampling events (Figure 6l). An increase in abundance was seen in April 2005 at KA. The abundance of nereid polychaetes increased substantially at MI, KA and GC between October 2004 and April 2005 (Figure 6m). *Orbinia papillosa* was found in low abundances at MI and KB during the period reported here. (Figure 6n).

Note that indicator amphipods were only found in extremely low abundances so are not presently graphically in this report.

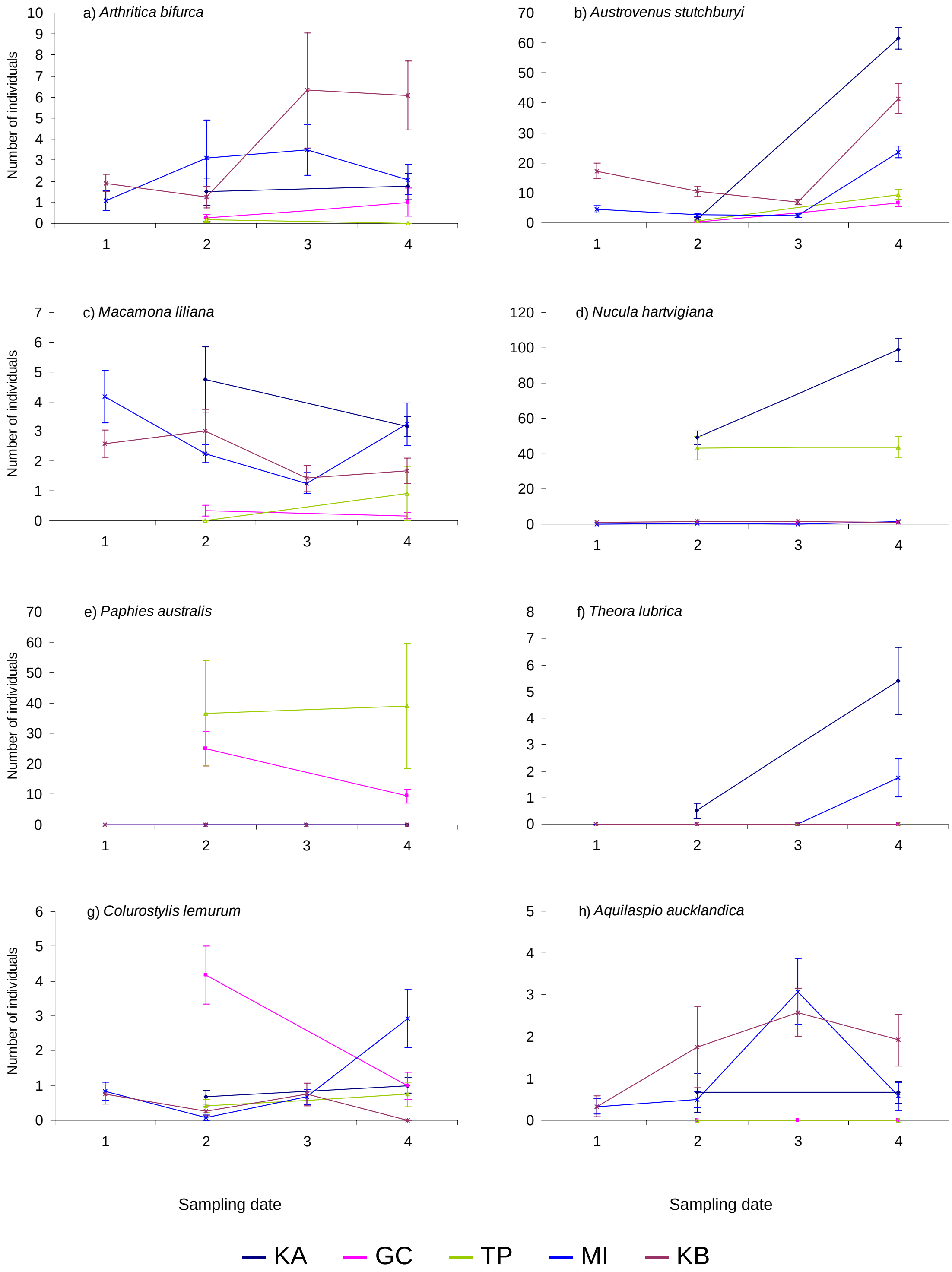

Figure 6: **The mean (± standard error) number of selected indicator species/taxa per core on each sampling date at each of the permanent monitoring sites in the southern Firth of Thames. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4. Note the different scales on the vertical axes.**

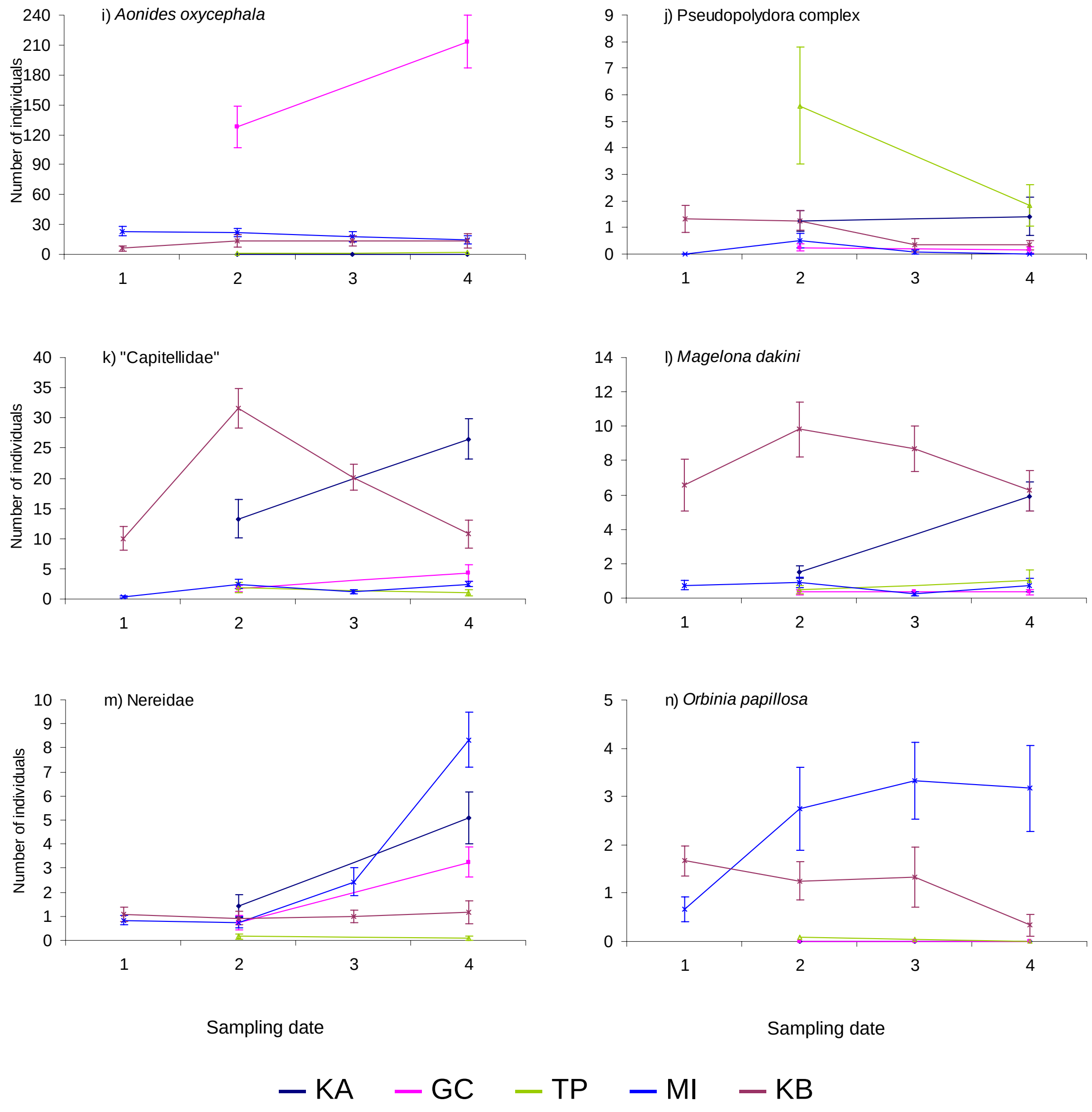

Figure 6. (cont.)

3.2.2 Whaingaroa (Raglan) Harbour

The five most common species/taxonomic groups (indicator and non-indicator) at each of the permanent monitoring sites in Whaingaroa (Raglan) Harbour on each sampling date between July 2004 and April 2005 are listed in Table 3.

At the sampling sites TU, X and HB, the most abundant taxa remained the same over all sampling dates. At TU, the bivalve species *Austrovenus stutchburyi* (36-122 individuals core^{-1}) and *Nucula hartvigiana* (21-57 individuals core^{-1}) were the most common taxa on both sampling dates. The limpet, *Notoacmea* sp*.* (1-34 individuals core^{-1}) and non-indicator gastropods ('other gastropods', 1-24 individuals core^{-1}) were also among the most common species, but in lower numbers. At X, the bivalves *A. stutchburyi* (6-105 individuals core^{-1}) and *N. hartvigiana* (0-62 individuals core^{-1}) were again the most abundant taxa on both sampling dates. The bivalve *Macamona liliana* and polychaete *Aquilaspio aucklandica* were frequent on both sampling dates. At HB, capitellid polychaetes were the most abundant taxa on both sampling dates (3-21 individuals core^{-1}). The second most abundant taxa changed from *A. stutchburyi* in October 2004 (0-13 individuals core^{-1}) to another bivalve, *M. liliana*, in April 2005 (1-15 individuals core^{-1}). The bivalve *Arthritica bifurca* and nereid polychaetes were also abundant on both sampling dates at HB.

At sites WI and OB, the most abundant taxa changed slightly over the sampling dates. At WI *A. stutchburyi* was most abundant in July and October 2004 (22-123 individuals core^{-1}) and N. *hartvigiana* in January and April, 2005 (15-74 individuals core^{-1}). Capitellid polychaetes were also high in abundance (6-77 individuals core^{-1}) on each sampling date. *Notoacmea* sp (4-47 individuals core^{-1}) and *A. aucklandica* (0-43 individuals core^{-1}) were also common taxa on three and two of the four sampling dates, respectively. At OB the most abundant taxa changed from capitellids in July 2004 (7-53 individuals core^{-1}) to *Cossura* sp. polychaetes (0-63 individuals core^{-1}) on subsequent sampling dates. The third most abundant taxa on three of the sampling dates was *A. aucklandica* (0-39 individuals core^{-1}). Other abundant taxa found on at least half of the sampling dates and in lower numbers included the amphipod taxa *phoxocephalidae* (0-17 individuals core^{-1}*)*, non-indicator polychaetes (0-10 individuals core^{-1}), and non-indicator gastropods (0-11 individuals core^{-1}).

Table 3: The five most common species/taxonomic groups on each sampling date for each permanent monitoring site in Whaingaroa Harbour. 'Misc. Other', 'Other polychaetes', 'Other bivalves', 'Other gastropods' and 'Other amphipods' denote non-indicator species of these taxonomic groups.

	TU	HB	X	WI	OB
Jul-04				*Austrovenus*	Capitellidae
				Nucula	*Cossura* sp.
				Capitellidae	Other gastropods
				Other gastropods	Other polychaetes
				Other polychaetes	*Paraonidae*
Oct-04	*Austrovenus*	Capitellidae	*Austrovenus*	*Austrovenus*	*Cossura* sp.
	Nucula	*Austrovenus*	*Nucula*	Capitellidae	Capitellidae
	Other gastropods	*Arthritica*	Misc. Other	*Nucula*	*Aquilaspio*
	Notoacmea sp.	Nereidae	*Macamona*	Misc. Other	Phoxocephalidae
	Arthritica	Phoxocephalidae	*Aquilaspio*	*Notoacmea* sp.	Other polychaetes
Jan-05				*Nucula*	*Cossura* sp.
				Austrovenus	Capitellidae
				Capitellidae	*Aquilaspio*
				Notoacmea sp.	Phoxocephalidae
				Aquilaspio	Other polychaetes
Apr-05	*Austrovenus*	Capitellidae	*Austrovenus*	*Nucula*	*Cossura sp.*
	Nucula	*Macamona*	*Nucula*	*Aquilaspio*	Capitellidae
	Notoacmea sp.	*Arthritica*	Capitellidae	*Austrovenus*	*Aquilaspio*
	Aquilaspio	*Austrovenus*	*Aquilaspio*	Capitellidae	Other gastropods
	Other gastropods	Nereidae	*Macamona*	*Notoacmea* sp.	Phoxocephalidae

The mean abundances of selected indicator species/taxa at each of the sites on each sampling date are shown in Figure 7.

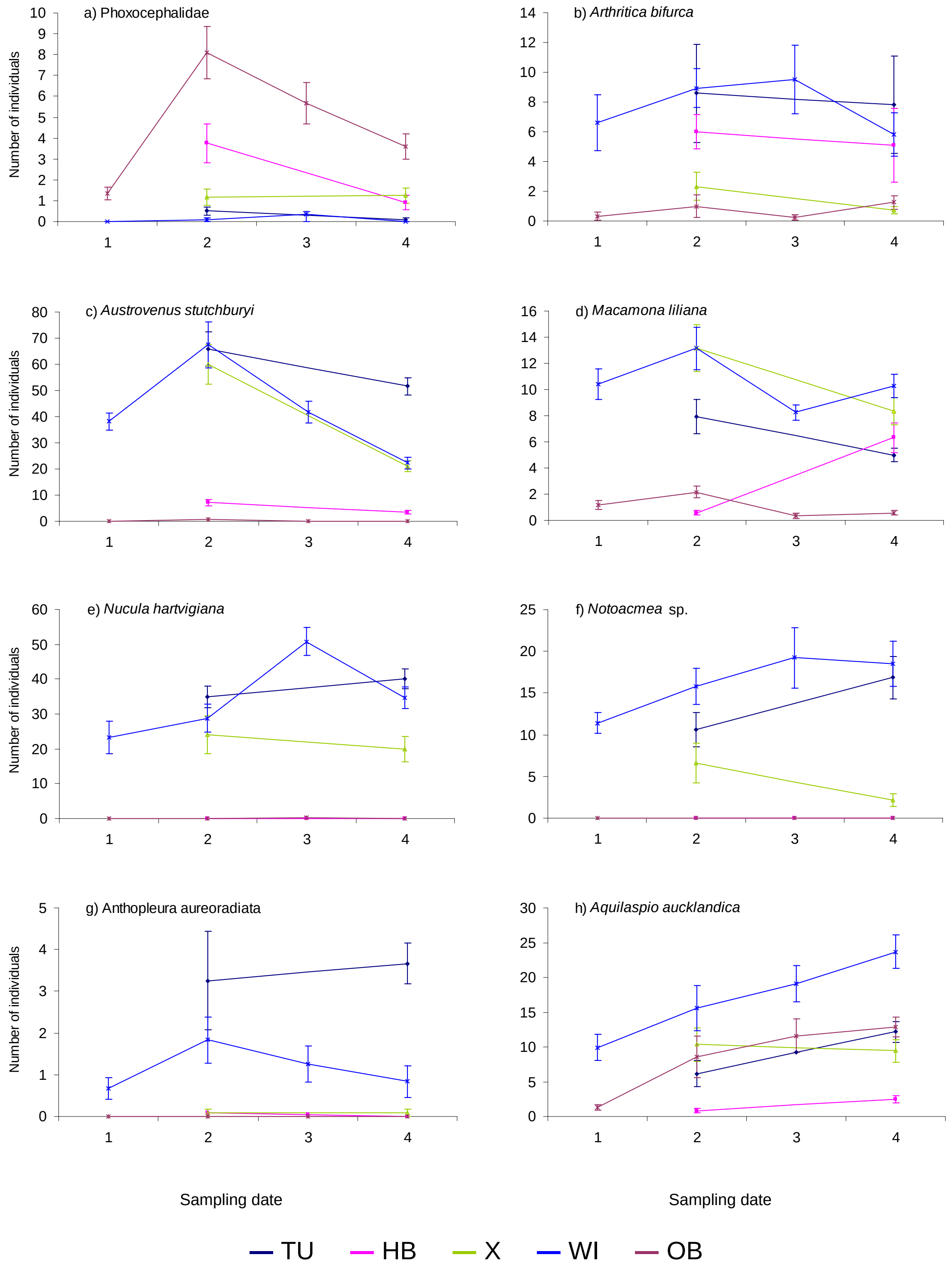

Figure 7: **The mean (± standard error) number of selected indicator species/taxa per core on each sampling date at each of the permanent monitoring sites in Whaingaroa Harbour. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4. Note the different scales on the vertical axis.**

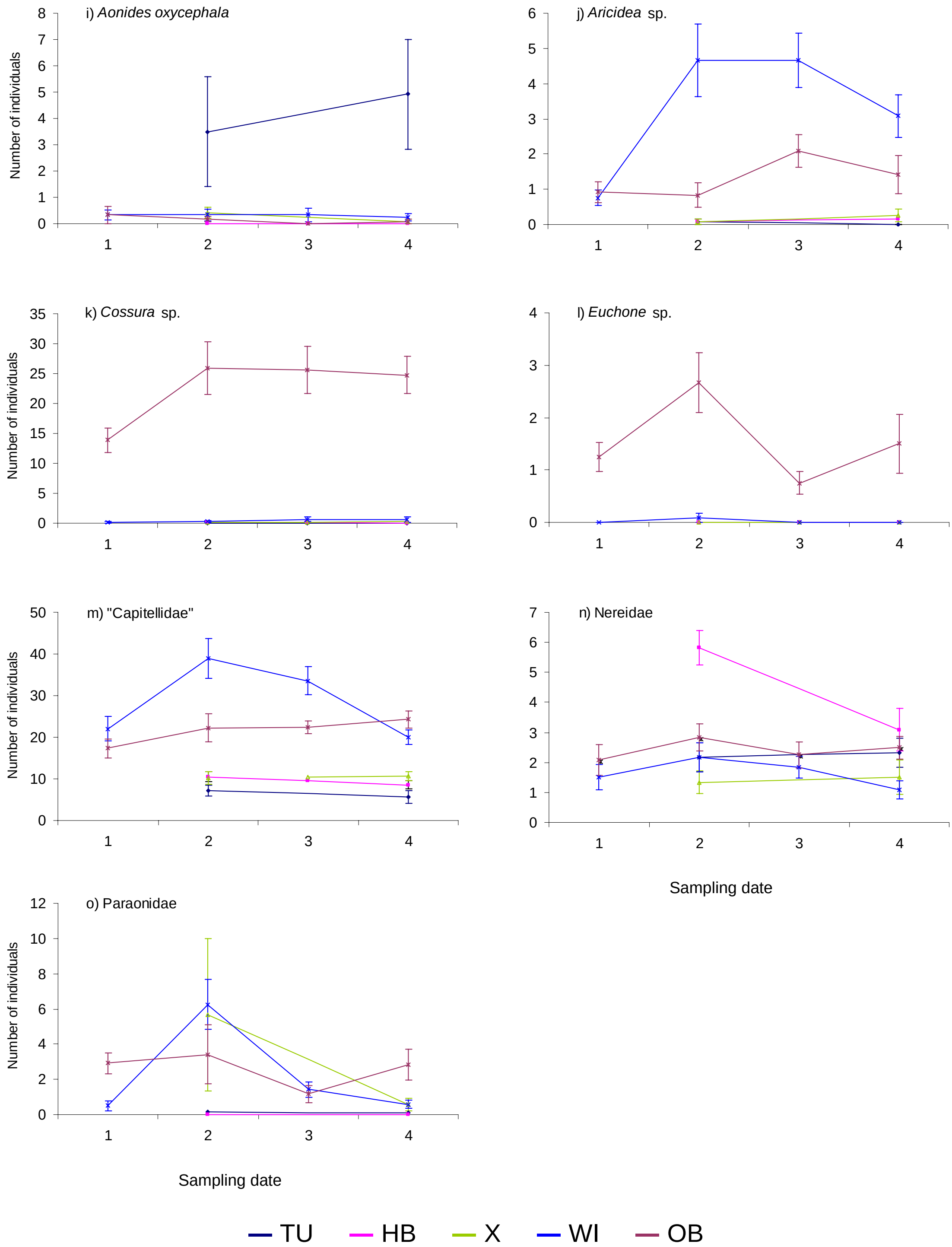

Figure 7. (cont.)

The highest abundance of phoxocephalid amphipods occurred at OB, where a sharp increase in numbers occurred between July and October 2004, followed by a steady decline on subsequent sampling dates. A decline in numbers was also seen at HB between October 2004 and April 2005 (Figure 7a).

Indicator bivalves were abundant and showed much variation between sites and over time. *Arthritica bifurca* was present in highest numbers at WI, TU and HB, and in lower numbers at X and OB (Figure 7b). Like in the Firth of Thames, the majority of *A. bifurca* recorded from Raglan Harbour were <2 mm. Very high numbers of *Austrovenus stutchburyi* were found at TU, WI and X in October 2004, with a decline in abundance on subsequent sampling dates (Figure 7c). This can be mainly attributed to a decrease in abundance of individuals <5 mm. The abundance of *Macamona liliana* was generally highest at WI, X and TU (Figure 7d), with lower numbers at OB and HB (except in April 2005, when there was a significant increase in abundance of the size class <5 mm at

HB). At site X and TU the abundance decreased slightly between October 2004 and April 2005 (mainly due to a decrease in individuals <5 mm), whereas at WI numbers increased somewhat in October 2004 and then again in April 2005. Once again this was a reflection of changes in abundance of individuals <5 mm. High numbers of *Nucula hartvigiana* occurred at TU, WI and X (Figure 7e). The abundance at X and TU was relatively consistent, whereas a peak in abundance was observed in January, 2005 at WI, followed by a decrease in April 2005. This pattern was mainly caused by changes in numbers of the size class <2 mm.

The abundance of the limpet *Notoacmea* sp. was highest at WI and TU, with lower numbers at X (Figure 7f). At WI there was a gradual increase in abundance over time with levels peaking in January 2005 and staying consistent in April 2005. At TU the abundance observed was highest in April 2005, whereas numbers decreased between October 2004 and April 2005 at X. The anemone *Anthopleura aureoradiata* was present in highest numbers at TU and WI (Figure 7g). At WI an initial increase in abundance between July and October 2004 was followed by a gradual decline on subsequent sampling dates.

The abundance of polychaetes also varied over time and between sites. The abundance of *Aquilaspio aucklandica* was highest at WI, with medium levels found at OB, X and TU, and lower numbers at HB (Figure 7h). Abundance increased over time at sites WI, OB and TU. The abundance at HB and X was relatively consistent, with only a small change in numbers. *Aonides oxycephala* had the highest number of individuals at TU (Figure 7i). All other sites had very low levels. The polychaete *Aricidea* sp. was most abundant at WI, where numbers initially increased between July and October 2004, following which a slight decrease occurred. This species was present at low levels at OB, where numbers where relatively consistent with a slight peak in January, 2005 (Figure 7j).

The abundance of the polychaetes *Cossura* sp. and *Euchone* sp. was clearly highest at OB, with extremely low or no individuals occurring at the other sites. The abundance of *Cossura* sp. was very consistent at OB after an initial peak in observed individuals in October 2004 (Figure 7k). For *Euchone* sp. slight peaks in numbers were observed in October 2004 and April 2005 (Figure 7l).

Capitellid polychaetes occurred in relatively high numbers at all sites, in particular WI and OB (Figure 7m). At WI a peak in numbers was observed in October 2004, followed by a gradual decline between October 2004 and April 2005. The abundance at all other sites was consistent between the sampling dates, with a slight overall increase in numbers at OB. The abundance of nereid polychaetes was highest at HB in October 2004, after which a decline was observed in April 2005 (Figure 7n). All other sites had similar low and consistent abundances of nereids. Paraonid numbers at WI and X declined to low levels in April 2005 (Figure 7o), whereas at OB a slight peak was observed in April 2005.

3.3 Changes in the Composition of Indicator Species/Taxa Assemblages

3.3.1 Southern Firth of Thames

Figure 8 shows the non-metric multi-dimensional scaling (MDS) ordination of the square-root transformed benthic macrofauna assemblage data at each of the five monitoring sites from July 2004 to April 2005.

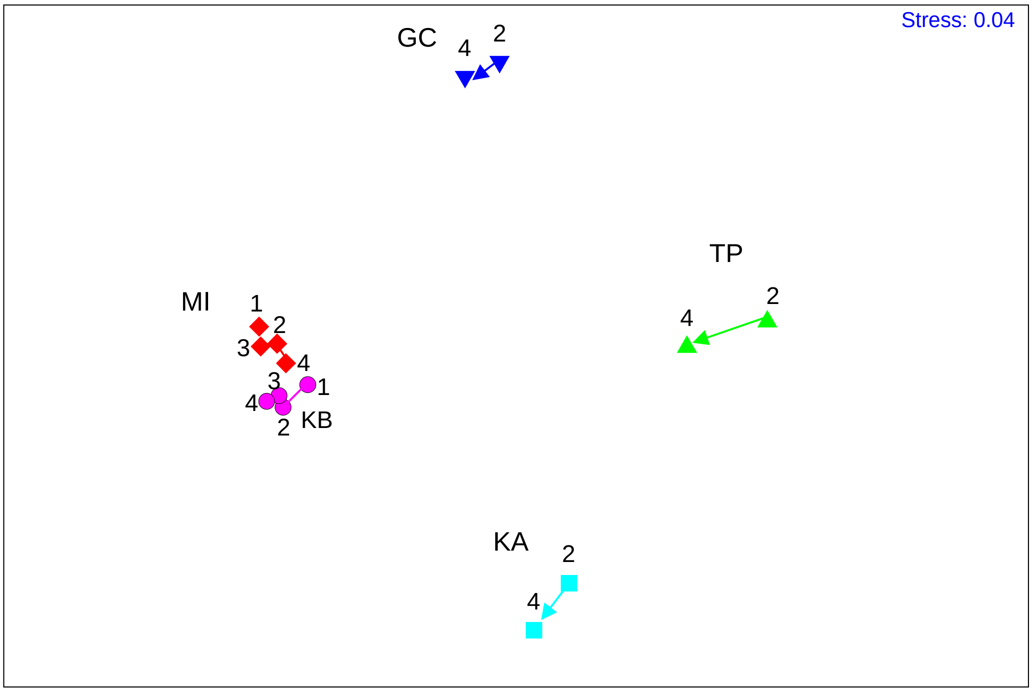

Figure 8: **Non-metric multi-dimensional scaling (MDS) ordination of the square-root transformed southern Firth of Thames benthic macrofauna assemblage data based on mean abundance values for each indicator taxa from all the samples at each site on each sampling date. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4**

The MDS plot provides a visual representation of the relative similarities of the assemblages of indicator taxa at the various sites and sampling times. It constructs a “map’ or arrangement of the macrofauna assemblage at each sampling site. The stress value provides a measure of how well high dimensional data (i.e. macrofauna abundance) can be presented in a low dimensional space (i.e., MDS plot). The distances between points (samples) reflects their relative dissimilarity in species composition: points that are close together have very similar assemblages, points which are far apart have few species in common, or the same species but at different levels of abundance. The arrowed lines linking the points indicate the direction of change through time; the longer the line the more the assemblages have changed. The low stress value (0.04) for the two-dimensional ordination indicates that the representation of the similarities in assemblage composition was excellent.

The MDS plot (Figure 8) shows that the five sites formed separate clusters, indicating that the macrobenthic communities at each site in the Firth of Thames were distinctly different from each other. The communities at MI and KB were most similar (clusters close together), with sites GC, TP and KA forming the most distinct communities from other sites.

A MDS plot can show whether there were changes in communities over time. The relatively tight clustering of data points at MI, KB, KA and GC indicate the macrobenthic communities did not change much over time, although it is evident that at these sites the community at the first sampling event was slightly different than that found in April 2005. A slightly larger change in community composition occurred at TP. There appeared to be a similar directional change in community assemblage over time at TP, KA, KB and GC.

With the limited amount of sample/data points (in particular at sites GC, KA and TP with only two data points) it is difficult to see any real patterns of change over time. Any changes in the pattern of macrobenthic community assemblage over time should become more apparent when a summary of the first five years of the monitoring programme is analysed in an upcoming trend report.

The ANOSIM global test (shown in Table 4) was used to indicate whether there were significant differences between any of the sampling dates at each site. The tests indicate that for all of the five sites, there were significant differences in assemblage composition between sampling dates at the $P < 0.01$ level. The high global R value at KA (0.875)[7] indicates clear separation of the community composition between sampling dates. The mid-range global R values at MI (0.482), GC (0.403) and KB (0.401) indicate the community at these sites were separated with some degree of overlap between sampling dates. A relatively low global R value at TP (0.188) indicates the community between sampling dates was barely separable.

The significant differences at each site were explored further using ANOSIM pairwise comparison tests.

Table 4: ANOSIM pairwise tests of the square-root transformed southern Firth of Thames benthic macrofauna assemblage data based on mean abundance values for each indicator species/taxa from all the samples at each site on each sampling date.

Pairwise	KA		GC		TP		MI		KB	
Comparison	*R*	*P*	*R*	*P*	*R*	*P*	*R*	*P*	*R*	*P*
Jul-04, Oct-04	-	-	-	-	-	-	0.133	*	0.346	**
Jul-04, Jan-05	-	-	-	-	-	-	0.376	**	0.406	**
Jul-04, Apr-05	-	-	-	-	-	-	0.731	**	0.393	**
Oct-04, Jan-05	-	-	-	-	-	-	0.180	*	0.141	*
Oct-04, Apr-05	0.875	**	0.403	**	0.188	**	0.711	**	0.614	**
Jan-05, Apr-05	-	-	-	-	-	-	0.675	**	0.476	**
Global R	0.875	**	0.403	**	0.188	**	0.482	**	0.401	**

Sites KA, GC and TP were only sampled in October 2004 and April 2005, so the *R* value presented is the global *R* value.

** $P < 0.01$
* $P < 0.05$
ns $P > 0.05$
- no pairwise comparison as the site was not sampled on all possible dates

At KA, GC and TP the two sampling dates (October 2004 and April 2005) were significantly ($P < 0.01$) different from each other. The highest pairwise R values (in effect the global R value) and therefore greatest degree of community composition separation was found at KA (0.875, well separated), followed by GC (0.403, degree of overlap) and a much lower R value at TP (0.188, barely separable).

At MI and KB all four sampling dates (July and October 2004, January and April 2005) were significantly different from each other. Different degrees of separation in community composition were seen at MI with R values ranging from 0.133 to 0.731. The highest pairwise R values ($R > 0.675$) were between April 2005 and the other three sampling dates, indicating that a change in the community composition was observed in April 2005. The assemblages at MI between July and October 2004 (R = 0.133), and October 2004 and January 2005 (R = 0.180) were very similar. Four of the six pairwise comparisons at KB had mid-range R values (0.346 to 0.476), indicating separation with some overlap between community compositions over these sampling dates. The samples of October 2004 and January 2005 were barely separable (R = 0.141), whereas the greatest difference at KB occurred between October 2004 and April 2005 (R = 0.614).

From the data presented here there is insufficient information to assess any patterns in community change over time. However the analysis suggests there may be seasonal differences between macrofaunal assemblages at each of the sites in the Firth of Thames.

[7] R values can be interpreted as follows; $R > 0.75$ = well separated, R > 0.5 = overlapping but clearly different, R < 0.25 barely separable (Clarke and Gorley, 2001).

The smallest combination of indicator species/taxa at each of the sites in the southern Firth of Thames which best accounts for the pattern represented by the full set of indicator species/taxa over the first year of the monitoring programme, were determined using BVSTEP, the results from which are listed in Table 5. The five species/taxa which contributed most to determining the Bray-Curtis dissimilarities between all the sampling dates during the first year of the monitoring programme at each of the sites were ascertained using SIMPER, and are listed in Table 6. In the SIMPER results, species/taxa are ordered by their average contribution to the total average dissimilarity between Sample Dates. The percentage of the total dissimilarity that is contributed by each species is also given, and these percentages are then cumulated. Note that only the first five species are listed in each case, which for the southern Firth of Thames sites accounted for between 49-74% of the dissimilarity between sample dates.

The combination of indicator species/taxa that best accounted for the pattern of the full set of indicator species/taxa over this study period (July 2004 – April 2005), and the indicator species/taxa which contributed most to the dissimilarities between sampling dates, differed among the monitoring sites. The bivalve species *Austrovenus stutchburyi* (all sites), *Nucula hartvigiana* (KA, KB and TP), capitellid and nereid polychaetes (KA, KB, MI and GC), and *Aonides oxycephala* (GC, TP, MI and KB) consistently accounted for a large portion of the full pattern across most sites.

At TP five of the total of 26 indicator species accounted for the majority of the full pattern ($\rho = 0.958$) (Table 5). Of these five species, four (the bivalves *A. stutchburyi, N. hartvigiana* and *Paphies australis*; and polydorid polychaetes) were important in contributing to the differences in assemblage composition between October 2004 and April 2005 (Table 6). At KA, six species accounted for a large proportion of the full pattern ($\rho = 0.952$) (Table 5). Of these the bivalves *A. stutchburyi,* and *N. hartvigiana*, along with capitellid and nereid polychaetes were also important in contributing to the differences between sampling dates at KA (Table 6). The bivalve species *A. stutchburyi* and *P. australis,* and the polychaetes *A. oxycephala,* capitellids and nereids, accounted for most of the full pattern at GC ($\rho = 0.963$) (Table 5). All of these except capitellids were significant in contributing to the differences between sampling dates (Table 6). At MI, 10 species explained the majority of the full pattern ($\rho = 0.963$) (Table 5). Of these only the polychaete *A. oxycephala* was consistently important in contributing to the differences in assemblage composition among sampling dates (Table 6). At KB 10 species also accounted for most of the full pattern ($\rho = 0.953$) (Table 5). Four of these species (the polychaetes *A. oxycephala* and capitellids; and the bivalves *A. stutchburyi* and *A. bifurca*) were consistently important in contributing to differences found between sampling date (Table 6).

Table 5: BVSTEP analysis to identify the smallest subset of indicator species/taxa whose similarity matrix across all the sample dates at each permanent monitoring site in the southern Firth of Thames correlated with that for the full indicator species/taxa set, at ρ ≥ 0.95.

Site	Correlation (ρ)	Species/Taxa
KA	0.952	*Austrovenus stutchburyi* *Nucula hartvigiana* Pseudopolydora complex Capitellidae *Magelona dakini* Nereidae
GC	0.963	*Austrovenus stutchburyi* *Paphies australis* *Aonides oxycephala* Capitellidae Nereidae
TP	0.958	*Austrovenus stutchburyi* *Nucula hartvigiana* *Paphies australis* *Aonides oxycephala* Pseudopolydora complex
MI	0.963	*Colurostylis lemurum* *Arthritica bifurca* *Austrovenus stutchburyi* *Macamona liliana* *Aquilaspio aucklandica* *Aonides oxycephala* Capitellidae *Magelona dakini* Nereidae *Orbinia papillosa*
KB	0.953	*Arthritica bifurca* *Austrovenus stutchburyi* *Macamona liliana* *Nucula hartvigiana* *Aquilaspio aucklandica* *Aonides oxycephala* Capitellidae *Magelona dakini* Nereidae *Orbinia papillosa*

Table 6: SIMPER analysis breakdown of average dissimilarity between Sample Dates at each of the permanent monitoring sites in the southern Firth of Thames into contributions from each indicator species/taxa.

KA	Species/Taxa	Average Abun-dance Date 1	Average Abun-dance Date 2	Average Dissimilarity	Contribution %	Cum. Contribution %
KA Oct-04 & Apr-05 dissimilarity = 41.85	*Austrovenus stutchburyi*	0.95	7.81	12.48	29.81	29.81
	Nucula hartvigiana	6.95	9.87	5.39	12.87	42.68
	Capitellidae	3.42	5.04	3.52	8.42	51.11
	Theora lubrica	0.35	2.14	3.34	7.98	59.08
	Nereidae	0.88	2.14	2.50	5.98	65.07
GC						
GC Oct-04 & Apr-05 dissimilarity = 34.49	*Aonides oxycephala*	10.81	14.25	10.36	30.05	30.05
	Paphies australis	4.70	2.81	4.99	14.48	44.53
	Austrovenus stutchburyi	0.28	2.44	4.62	13.40	57.93
	Colurostylis lemurum	1.92	0.68	2.92	8.47	66.40
	Nereidae	0.55	1.67	2.71	7.86	74.26
TP						
TP Oct-04 & Apr-05 dissimilarity = 37.71	*Paphies australis*	5.13	5.13	7.62	20.20	20.20
	Austrovenus stutchburyi	0.53	2.94	6.96	18.47	38.67
	Nucula hartvigiana	6.33	6.45	5.41	14.36	53.03
	Pseudopolydora complex	1.92	0.84	4.71	12.50	65.53
	Capitellidae	0.94	0.66	2.72	7.20	72.73
MI						
MI Jul-04 & Oct 04 dissimilarity = 40.91	*Aonides oxycephala*	4.48	4.41	7.08	17.30	17.30
	Orbinia papillosa	0.52	1.35	4.21	10.29	27.59
	Arthritica bifurca	0.74	1.00	4.20	10.27	37.86
	Capitellidae	0.28	1.25	4.12	10.06	47.92
	Macamona liliana	1.81	1.41	3.52	8.60	56.52
MI Jul-04 & Jan-04 dissimilarity = 44.47	*Aonides oxycephala*	4.48	3.91	6.98	15.70	15.70
	Aquilaspio aucklandica	0.28	1.57	5.01	11.26	26.96
	Orbinia papillosa	0.52	1.53	4.79	10.77	37.73
	Macamona liliana	1.81	0.93	4.43	9.96	47.69
	Arthritica bifurca	0.74	1.41	4.42	9.94	57.63
MI Jul-04 & Apr-05 dissimilarity = 48.79	*Austrovenus stutchburyi*	1.93	4.81	8.66	17.75	17.75
	Aonides oxycephala	4.48	3.36	6.44	13.20	30.94
	Nereidae	0.74	2.82	6.30	12.92	43.86
	Orbinia papillosa	0.52	1.41	3.71	7.60	51.46
	Capitellidae	0.28	1.44	3.62	7.42	58.88
MI Oct-04 & Jan-05 dissimilarity = 41.21	*Aonides oxycephala*	4.41	3.91	6.19	15.02	15.02
	Arthritica bifurca	1.00	1.41	5.02	12.19	27.22
	Aquilaspio aucklandica	0.45	1.57	4.23	10.27	37.49
	Orbinia papillosa	0.64	1.40	4.00	9.72	47.20
	Nereidae	1.35	1.53	3.21	7.78	54.98
MI Oct-04 & Apr-05 dissimilarity = 49.58	*Austrovenus stutchburyi*	1.47	4.81	9.52	19.20	19.20
	Nereidae	0.64	2.82	6.31	12.72	31.92
	Aonides oxycephala	4.41	3.36	5.94	11.98	43.90
	Colurostylis lemurum	0.08	1.53	4.19	8.46	52.36
	Arthritica bifurca	1.00	1.16	3.58	7.23	59.58
MI Jan-05 & Apr-05 dissimilarity = 45.96	*Austrovenus stutchburyi*	1.39	4.81	9.46	20.58	20.58
	Aonides oxycephala	3.91	3.36	5.05	10.99	31.57
	Nereidae	1.40	2.82	4.10	8.91	40.48
	Aquilaspio aucklandica	1.57	0.42	3.64	7.92	48.40
	Arthritica bifurca	1.41	1.16	3.35	7.30	55.70
KB						
KB Jul-04 & Oct 04 dissimilarity = 36.88	Capitellidae	3.02	5.53	6.32	17.14	17.14
	Aonides oxycephala	1.92	2.78	4.90	13.28	30.42
	Austrovenus stutchburyi	3.96	3.09	3.72	10.10	40.52
	Magelona dakini	2.31	3.02	3.01	8.16	48.68
	Arthritica bifurca	1.28	0.70	2.42	6.55	55.23

Table 6. (cont.)

KB	*Species/Taxa*	Average Abun-dance Date 1	Average Abun-dance Date 2	Average Dissimilarity	Contribution %	Cum. Contribution %
KB Jul-04 & Jan-04 dissimilarity = 37.97	*Aonides oxycephala*	1.92	3.09	5.22	13.73	13.73
	Austrovenus stutchburyi	3.96	2.56	4.44	11.70	25.43
	Capitellidae	3.02	4.42	3.95	10.41	35.84
	Arthritica bifurca	1.28	1.90	3.32	8.73	44.58
	Aquilaspio aucklandica	0.23	1.45	3.22	8.47	53.05
KB Jul-04 & Apr-05 dissimilarity = 38.25	*Austrovenus stutchburyi*	3.96	6.30	6.29	16.44	16.44
	Aonides oxycephala	1.92	2.70	5.19	13.58	30.02
	Arthritica bifurca	1.28	2.02	3.58	9.37	39.40
	Capitellidae	3.02	3.05	3.06	7.99	47.39
	Magelona dakini	2.31	2.37	2.67	6.98	54.37
KB Oct-04 & Jan-05 dissimilarity = 33.46	*Aonides oxycephala*	2.78	3.09	4.94	14.76	14.76
	Arthritica bifurca	0.70	1.90	3.59	10.73	25.49
	Capitellidae	5.53	4.42	3.24	9.67	35.16
	Aquilaspio aucklandica	0.88	1.45	2.41	7.21	42.38
	Austrovenus stutchburyi	3.09	2.56	2.34	6.99	49.36
KB Oct-04 & Apr-05 dissimilarity = 41.71	*Austrovenus stutchburyi*	3.09	6.30	7.37	17.68	17.68
	Capitellidae	5.53	3.05	5.85	14.03	31.71
	Aonides oxycephala	2.78	2.70	4.98	11.93	43.65
	Arthritica bifurca	0.70	2.02	3.89	9.32	52.97
	Glycera sp.	1.33	0.25	2.56	6.15	59.12
KB Jan-05 & Apr-05 dissimilarity = 38.83	*Austrovenus stutchburyi*	2.56	6.30	8.70	22.41	22.41
	Aonides oxycephala	3.09	2.70	5.32	13.71	36.12
	Arthritica bifurca	1.90	2.02	4.06	10.45	46.57
	Capitellidae	4.42	3.05	3.78	9.74	56.31
	Magelona dakini	2.83	2.37	2.31	5.94	62.25

In the Firth of Thames there were no pronounced differences between sampling dates at any of the sites. The average dissimilarity among sampling dates was relatively similar between different sites with no clear high or low values. This is reflected in the MDS plot (Figure 8) where there was relatively tight clustering of the data points at each site (in particular MI and KB).

The combination of indicator species/taxa that best accounted for the pattern of the full set of indicator species/taxa over the study period (July 2004 – April 2005), and the indicator species/taxa which contributed most to the dissimilarities between sampling dates, differed among the monitoring sites.

3.3.2 Whaingaroa (Raglan) Harbour

The MDS ordination of the square-root transformed benthic macrofauna assemblage data at each of the five permanent monitoring sites over the period July 2004-April 2005 is presented in Figure 9.

In Raglan Harbour sites TU, X and WI were most similar (sites overlap) in their macrofauna community assemblage, while the assemblage at HB and OB were clearly different from those at all other sites. The very low stress value (0.01) indicates that an excellent representation of the similarities in assemblage composition was achieved. The very tight clustering of data points at all Raglan sampling sites indicate the macrobenthic communities did not change significantly over time. A close–up of sites X, WI and TU is shown in Figure 10. At WI the community composition in April 2005 returned to one similar to that found in July 2004. Sites TU and X did not show any clear patterns of change over the study period.

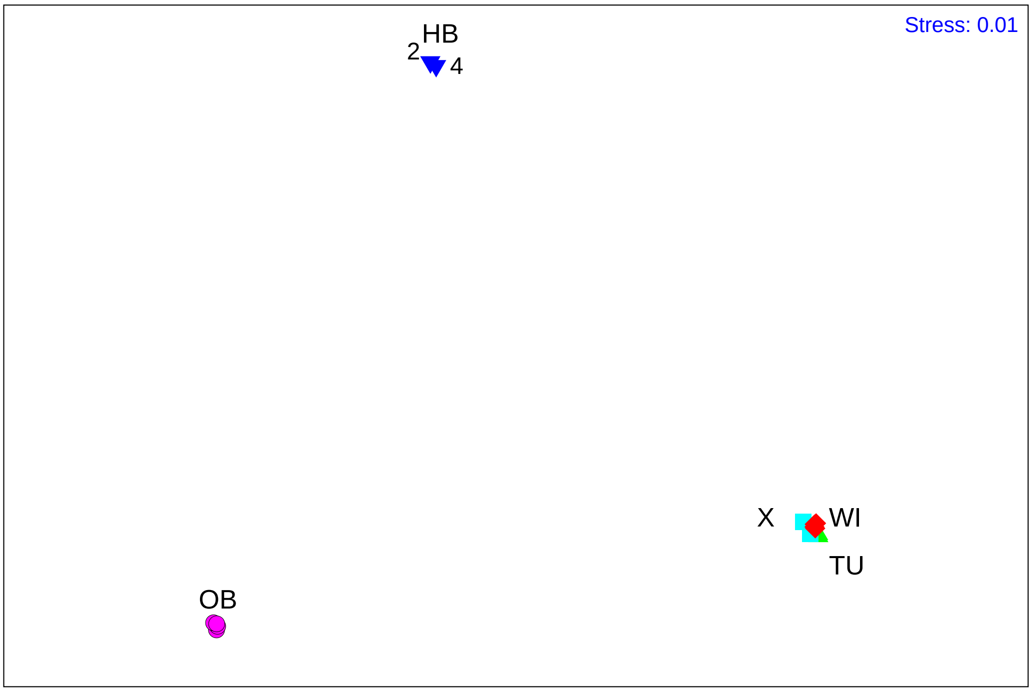

Figure 9: **Non-metric multi-dimensional scaling (MDS) ordination of the square-root transformed Whaingaroa Harbour benthic macrofauna assemblage data based on mean abundance values for each indicator taxa from all the samples at each site on each sampling date. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4.**

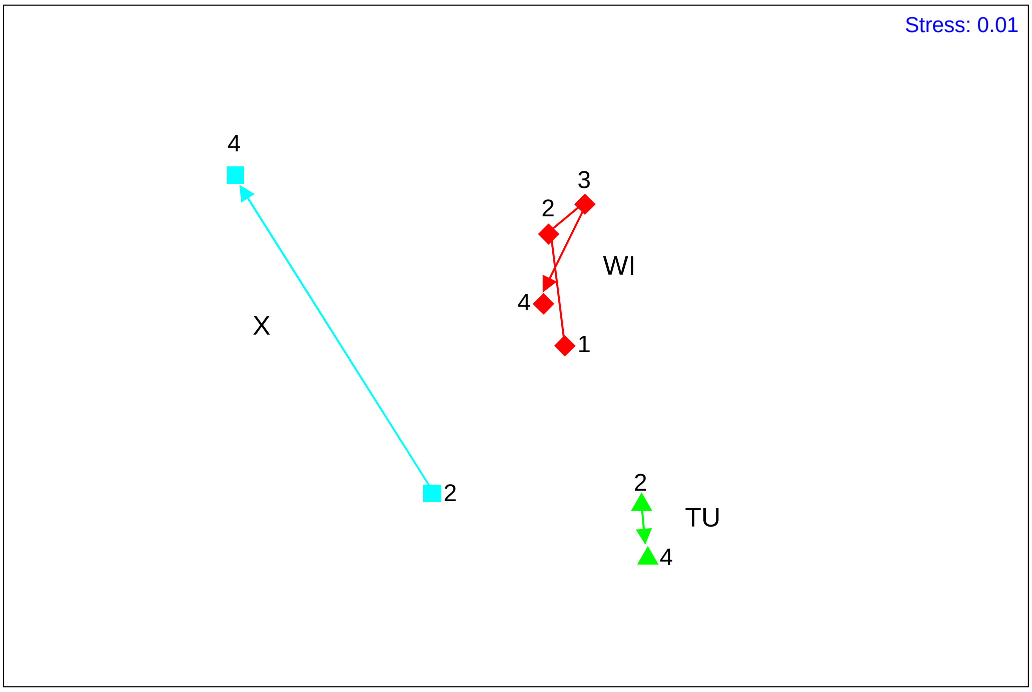

Figure 10: **Close-up of the non-metric multi-dimensional scaling (MDS) ordination of the square-root transformed Whaingaroa Harbour benthic macrofauna assemblage data based on mean abundance values for sites TU, X and WI. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4.**

The ANOSIM global test was used to assess whether there were significant differences between the sampling dates at each site. Results indicate that there were significant differences ($P < 0.01$) in assemblage composition at HB, WI, OB and X over the sampling dates. At TU there was no significant difference between the assemblages in October 2004 and April 2005. Although community compositions at WI, OB and X were significant, the global *R* values were relatively low (R = 0.206 – 0.377), indicating there was substantial overlap in assemblage composition between sampling dates. HB was the only site with a global R value of > 0.5, indicating the community at this site was separated with some degree of overlap between sampling dates.

The significant differences at each site were explored further using ANOSIM pairwise comparison tests, with results presented in Table 7.

Table 7: ANOSIM tests of the square-root transformed Whaingaroa Harbour benthic macrofauna assemblage data based on mean abundance values for each indicator species/taxa from all the samples at each site on each sampling date.

Pairwise	TU		HB		X		WI		OB	
Comparison	*R*	*P*	*R*	*P*	*R*	*P*	*R*	*P*	*R*	*P*
Jul-04, Oct-04	-	-	-	-	-	-	0.449	**	0.411	**
Jul-04, Jan-05	-	-	-	-	-	-	0.474	**	0.447	**
Jul-04, Apr-05	-	-	-	-	-	-	0.390	**	0.437	**
Oct-04, Jan-05	-	-	-	-	-	-	0.237	**	0.165	*
Oct-04, Apr-05	0.078	ns	0.504	**	0.206	**	0.488	**	0.259	**
Jan-05, Apr-05	-	-	-	-	-	-	0.258	**	0.116	*
Global R	0.078	ns	0.504	**	0.206	**	0.377	**	0.303	**

Sites TU, HB and X were only sampled in October 2004 and April 2005, so the *R* value presented is the global *R* value.

** $P < 0.01$
* $P < 0.05$
ns $P > 0.05$
- no pairwise comparison as the site was not sampled on all possible dates

At HB, X, WI and OB all sampling dates were significantly different. For all these sites apart from HB the pairwise R values were relatively low (R < 0.49). Therefore, although there were significant differences in assemblage composition over the sampling dates, there was a degree of overlap with some sampling dates being barely separable (e.g. OB: October 2004 versus January 2005, January vs. April 2005; WI: October 2004 versus January 2005; X: October 2004 versus April 2005). At HB the pairwise *R* value (in effect the global *R* value) between October 2005 and April 2005 was slightly higher, indicating the assemblage compositions between sampling dates at HB were more different (but still with some overlap) than at all other sites.

The purpose of this report is to document the data collected, rather than to identify any patterns in community change over time. This will be addressed in an upcoming trend report. However, the results suggest that there are not much seasonal differences among the benthic macrofauna assemblages at the sites, apart from at HB, in Whaingaroa (Raglan) Harbour.

The smallest combination of indicator species at each of the sites in Whaingaroa Harbour which best accounts for the pattern for the full set of indicator species from July 2004 to April 2005 are listed in Table 8. The five species which contributed most to determining the Bray-Curtis dissimilarities between all the sampling dates during this study period at each of the sites are listed in Table 9. Species/taxa are ordered by their average contribution to the total average dissimilarity between sample dates. The percentage of the total dissimilarity that is contributed by each species is also given, and these percentages are then cumulated. Note that only the first five species are listed in each case, which for the Whaingaroa Harbour sites accounted for between 42 and 64% of the dissimilarity between sample dates.

Table 8: BVSTEP analysis to identify the smallest subset of indicator species/taxa whose similarity matrix across all the sample dates at each permanent monitoring site in Whaingaroa Harbour correlated with that for the full indicator species/taxa set, at ρ ≥ 0.95.

Site	Correlation (ρ)	Species/Taxa
TU	0.955	*Colurostylis lemurum*
		Austrovenus stutchburyi
		Arthritica bifurca
		Nucula hartvigiana
		Notoacmea sp.
		Anthopleura aureoradiata
		Aquilaspio aucklandica
		Aonides oxycephala
		Glycera sp.
		Capitellidae
		Nereidae
HB	0.955	Phoxocephalidae
		Colurostylis lemurum
		Arthritica bifurca
		Austrovenus stutchburyi
		Macamona liliana
		Aquilaspio aucklandica
		Capitellidae
		Nereidae
X	0.960	*Colurostylis lemurum*
		Austrovenus stutchburyi
		Macamona liliana
		Nucula hartvigiana
		Notoacmea sp.
		Aquilaspio aucklandica
		Glycera sp.
		Capitellidae
		Paraonidae
WI	0.958	*Arthritica bifurca*
		Austrovenus stutchbury
		Nucula hartvigiana
		Notoacmea sp.
		Aquilaspio aucklandica
		Aonides oxycephala
		Aricidea sp.
		Glycera sp.
		Capitellidae
		Nereidae
		Paraonidae
OB	0.951	Phoxocephalidae
		Colurostylis lemurum
		Arthritica bifurca
		Macamona liliana
		Aquilaspio aucklandica
		Aricidea sp.
		Pseudopolydora complex
		Cossura sp.
		Euchone sp.
		Glycera sp.
		Capitellidae
		Nereidae
		Paraonidae

Table 9: SIMPER analysis breakdown of average dissimilarity between Sample Dates at each of the permanent monitoring sites in Whaingaroa Harbour into contributions from each indicator species/taxa.

TU	Species/Taxa	Average Abun-dance Date 1	Average Abun-dance Date 2	Average Dissimilarity	Contribution %	Cum. Contribution %
TU Oct-04 & Apr-05 dissimilarity = 22.59	*Aquilaspio aucklandica*	2.10	3.42	2.49	11.02	11.02
	Aonides oxycephala	1.14	1.52	2.48	10.96	21.98
	Arthritica bifurca	2.52	2.25	2.46	10.87	32.85
	Notoacmea sp.	3.06	3.97	2.10	9.28	42.14
	Austrovenus stutchburyi	8.01	7.14	1.91	8.46	50.60
HB						
HB Oct-04 & Apr-05 dissimilarity = 37.95	*Macamona liliana*	0.53	2.40	6.65	17.52	17.52
	Arthritica bifurca	2.32	1.73	4.81	12.68	30.20
	Austrovenus stutchburyi	2.49	1.61	4.68	12.34	42.54
	Phoxocephalidae	1.80	0.66	4.67	12.31	54.85
	Nereidae	2.38	1.60	3.52	9.28	64.13
X						
X Oct-04 & Apr-05 dissimilarity = 31.57	*Austrovenus stutchburyi*	7.58	4.50	5.66	17.94	17.94
	Nucula hartvigiana	4.48	4.07	4.00	12.68	30.61
	Notoacmea sp.	2.17	1.19	2.57	8.14	38.75
	Paraonidae	1.04	0.37	2.24	7.10	45.85
	Aquilaspio aucklandica	3.01	2.92	2.18	6.91	52.76
WI						
WI Jul-04 & Oct 04 dissimilarity = 25.68	*Austrovenus stutchburyi*	6.12	8.01	3.09	12.04	12.04
	Paraonidae	0.35	2.27	2.75	10.72	22.75
	Nucula hartvigiana	4.59	5.13	2.54	9.87	32.63
	Capitellidae	4.58	6.11	2.50	9.74	42.36
	Aquilaspio aucklandica	2.96	3.58	2.37	9.24	51.61
WI Jul-04 & Jan-04 dissimilarity = 24.05	*Nucula hartvigiana*	4.59	7.06	3.77	15.68	15.68
	Aquilaspio aucklandica	2.96	4.28	2.14	8.89	24.57
	Capitellidae	4.58	5.72	2.07	8.61	33.18
	Aricidea sp.	0.65	2.01	2.05	8.52	41.70
	Austrovenus stutchburyi	6.12	6.34	1.77	7.37	49.07
WI Jul-04 & Apr-05 dissimilarity = 22.99	*Aquilaspio aucklandica*	2.96	4.80	2.96	12.86	12.86
	Nucula hartvigiana	4.59	5.82	2.80	12.20	25.05
	Austrovenus stutchburyi	6.12	4.66	2.35	10.24	35.30
	Notoacmea sp.	3.32	4.15	1.96	8.52	43.82
	Arthritica bifurca	2.39	2.15	1.71	7.42	51.24
WI Oct-04 & Jan-05 dissimilarity = 21.39	*Austrovenus stutchburyi*	8.01	6.34	2.65	12.40	12.40
	Nucula hartvigiana	5.13	7.06	2.61	12.22	24.61
	Aquilaspio aucklandica	3.58	4.28	1.91	8.94	33.55
	Paraonidae	2.27	0.93	1.84	8.62	42.17
	Capitellidae	6.11	5.72	1.54	7.18	49.36
WI Oct-04 & Apr-05 dissimilarity = 24.59	*Austrovenus stutchburyi*	8.01	4.66	4.34	17.66	17.66
	Paraonidae	2.27	0.49	2.43	9.90	27.56
	Capitellidae	6.11	4.41	2.37	9.62	37.18
	Aquilaspio aucklandica	3.58	4.80	2.31	9.39	46.58
	Nucula hartvigiana	5.13	5.82	2.00	8.15	54.73
WI Jan-05 & Apr-05 dissimilarity = 20.13	*Austrovenus stutchburyi*	6.34	4.66	2.58	12.79	12.79
	Nucula hartvigiana	7.06	5.82	1.91	9.50	22.30
	Arthritica bifurca	2.82	2.15	1.89	9.41	31.70
	Capitellidae	5.72	4.41	1.85	9.19	40.90
	Notoacmea sp.	4.21	4.15	1.76	8.73	49.63
OB						
OB Jul-04 & Oct 04 dissimilarity = 39.13	*Cossura* sp.	3.51	4.88	4.57	11.67	11.67
	Phoxocephalidae	0.98	2.75	4.15	10.60	22.27
	Aquilaspio aucklandica	0.91	2.54	4.06	10.38	32.64
	Paraonidae	1.57	1.25	2.87	7.35	39.99
	Colurostylis lemurum	1.56	0.46	2.84	7.26	47.24

Table 9. (cont.)

OB	Species/Taxa	Average Abun-dance Date 1	Average Abun-dance Date 2	Average Dissimilarity	Contribution %	Cum. Contribution %
OB Jul-04 & Jan-04 dissimilarity = 37.51	*Aquilaspio aucklandica*	0.91	3.21	5.64	15.03	15.03
	Cossura sp.	3.51	4.86	4.74	12.64	27.68
	Phoxocephalidae	0.98	2.20	3.63	9.69	37.37
	Paraonidae	1.57	0.68	2.84	7.57	44.94
	Capitellidae	4.06	4.69	2.64	7.03	51.97
OB Jul-04 & Apr-05 dissimilarity = 36.91	*Aquilaspio aucklandica*	0.91	3.52	6.13	16.62	16.62
	Cossura sp.	3.51	4.88	3.98	10.78	27.40
	Capitellidae	4.06	4.88	2.77	7.49	34.90
	Colurostylis lemurum	1.56	0.98	2.37	6.41	41.31
	Phoxocephalidae	0.98	1.81	2.31	6.25	47.56
OB Oct-04 & Jan-05 dissimilarity = 30.57	*Cossura* sp.	4.88	4.86	3.50	11.45	11.45
	Aquilaspio aucklandica	2.54	3.21	3.19	10.42	21.88
	Paraonidae	1.25	0.68	2.52	8.24	30.12
	Macamona liliana	1.31	0.28	2.43	7.96	38.08
	Euchone sp.	1.49	0.65	2.15	7.04	45.13
OB Oct-04 & Apr-05 dissimilarity = 30.79	*Aquilaspio aucklandica*	2.54	3.52	3.13	10.17	10.17
	Cossura sp.	4.88	4.88	2.90	9.40	19.57
	Paraonidae	1.25	1.43	2.61	8.48	28.05
	Euchone sp.	1.49	0.83	2.26	7.33	35.38
	Phoxocephalidae	2.75	1.81	2.15	6.99	42.37
OB Jan-05 & Apr-05 dissimilarity = 27.73	*Cossura* sp.	4.86	4.88	3.08	11.12	11.12
	Paraonidae	0.68	1.43	2.52	9.08	20.20
	Aquilaspio aucklandica	3.21	3.52	2.51	9.04	29.25
	Phoxocephalidae	2.20	1.81	2.04	7.34	36.58
	Aricidea sp.	1.27	0.91	1.94	7.01	43.60

The bivalve species *Austrovenus stutchburyi* (TU, HB, X and WI) and *Arthritica bifurca* (TU, HB, WI, and OB); the polychaete species *Aquilaspio aucklandica* (all sites), capitellids (all sites) and nereids (TU, HB, WI and OB); and the cumacean *Colurostylis lemurum* (TU, HB, X and OB), consistently accounted for a large portion of the full pattern across most sites.

At TU 11 taxa accounted for a large proportion of the full pattern (ρ = 0.955) (Table 8). Of these, five taxa (the polychaetes *A. aucklandica* and *Aonides oxycephala*; the bivalves *A. stutchburyi* and *A. bifurca,* and the limpet *Notoacmea* sp.) were important in contributing to the differences in assemblage composition between October 2004 and April 2005 (Table 9). At HB eight taxa explained most of the full pattern (ρ = 0.955) (Table 8). Once again, five of these taxa were significant contributors to the difference between sampling dates (Table 9). Nine taxa at site X accounted for the majority of the full pattern (ρ = 0.955) (Table 8). Taxa which made important contributions to the assemblage differences between sampling dates were the bivalves, *A. stutchburyi* and *Nucula hartvigiana*; paraonid polychaetes and *A. aucklandica*; and the limpet, *Notoacmea* sp.) (Table 9). At WI 11 taxa accounted for nearly the entire full pattern (ρ = 0.958) (Table 8). Different combinations of taxa were important in contributing to the differences among sampling dates at WI, however two species (the bivalves *A. stutchburyi* and *N. hartvigiana*) were consistently important (Table 9). At OB 13 taxa accounted for the majority of the full pattern (ρ = 0.951) (Table 8). Only two of these taxa (the polychaetes *A. aucklandica* and *Cossura* sp.) were consistently important in contributing to the differences in assemblage composition among sampling dates at OB (Table 9).

Like in the Firth of Thames, there were no pronounced differences between sampling dates at any of the sites in Raglan Harbour. This is clearly reflected in the very tight clustering of the sampling dates at each site in the MDS ordination (Figure 9). The average dissimilarities between sampling dates were lower in Raglan Harbour than in the Firth of Thames, which is also reflected in the tighter clustering of data points in the Raglan MDS ordination (i.e. the assemblage composition was more similar between sampling dates in Raglan harbour than in the Firth of Thames). No consistent patterns were found in the dissimilarities between sampling dates among different monitoring sites.

3.4 Sediment Characteristics

3.4.1 Surficial Sediment Grain-Size

3.4.1.1 Southern Firth of Thames

The median grain size was very consistent at all sites in the Firth of Thames over the one year of data presented here (Figure 11a). The sediment at GC had the highest median grain size, with the other sites having similar low values. The proportion of mud was the lowest at GC (0.9-1.3%, Figure 11b). At KB there was a gradual decline in the proportion of mud from an average of 4.8% of the sediment by volume in July 2004 to 2.2% in April 2005. In the Firth of Thames, KA is generally the muddiest of the monitoring sites (Turner and Carter, 2004). However, since April 2003 (Felsing et al, 2006) and between July 2004 and April 2005 during this study period, similar levels of mud were found at KA and MI, with the average amount steadily declining from October 2004 to April 2005 at both sites (5.4% to 3.6% at KA, 5.6% to 3.5% at MI).

The data are included in full in Appendix 3.

3.4.1.2 Whaingaroa (Raglan) Harbour

At HB there was a marked decrease in median grain size from a mean of 231 µm in October 2004 to 95 µm in April 2005 (Figure 12a). However, in October 2004 there was a high standard error due to one anomalous sample in the set, resulting in a high average median grain size, 231.3 µm compared to 99.9 µm if the abnormal sample was removed. At WI a slight peak in median grain size was observed in January 2005, whereas sites TU, OB and X showed more consistent values over the study period.

The sediments at HB had the highest mean mud content (28.5-32.1%) (Figure 12b). The proportion of mud at HB has been consistently increasing since October 2002, when an amount of 12.6% was recorded (Felsing et al, 2006). Medium levels of mud were recorded at OB, where a decline was observed between October 2004 and January 2005. A similar pattern was seen at WI. Sites X and TU had consistently low levels of mud. The proportion of mud at HB and OB in Raglan was much higher than values observed for Firth of Thames sampling sites.

The data are included in full in Appendix 3.

3.4.2 Shell Hash

3.4.2.1 Southern Firth of Thames

The greatest mean dry weight of shell-hash was found at GC, where contents ranged from 829 $g.core^{-1}$ in October 2004 to 931 $g.core^{-1}$ in April 2005 (Figure 11c). All other sites had consistently lower amounts of shell material with the least being found at KA and TP (83-98 $g.core^{-1}$). The shell-hash content at GC was at least twice that at all other sites in both Firth of Thames and Raglan.

The data are included in full in Appendix 4.

3.4.2.2 Whaingaroa (Raglan) Harbour

In Raglan Harbour, sites X, TU, HB and WI had relatively similar amounts of shell-hash with the least occurring at OB (Figure 12c). At X there was a decrease in shell-hash from 257 $g.core^{-1}$ in October 2004 to 186 $g.core^{-1}$ in April 2005. The amount of shell-hash at HB, TU and OB was consistent over the study period, and showed no clear trend at WI (although there was a peak of 220 $g.core^{-1}$ in October 2004).

The data are included in full in Appendix 4.

3.4.3 Sediment Organic Matter Content

3.4.3.1 Southern Firth of Thames

There was a decrease in total organic carbon levels at KA from a mean of 0.496 g 100 g^{-1} in October 2004 to 0.308 g 100 g^{-1} in April 2005 (Figure 11d). A decrease was also seen at KB where levels dropped to 0.312 g 100 g^{-1} in April 2005, similar to previous levels in July 2004 (0.300 g 100 g^{-1}). In contrast a substantial increase in total organic carbon occurred at GC (from 0.294 g 100 g^{-1} in October 2004 to 0.498 g 100 g^{-1} in April 2005). A gradual decline occurred at MI from July 2004 to January 2005, followed by a slight increase in April 2005. Total organic levels at TP were consistently low over the study period.

The mean total nitrogen content of the sediments at KB increased from July 2004 to January 2005, followed by a decrease in April 2005, whereas those at GC and TP showed an increase between October 2004 and April 2005 (Figure 11e). The nitrogen content at MI and KA was relatively consistent over the study period.

The data are included in full in Appendix 5.

3.4.3.2 Whaingaroa (Raglan) Harbour

The highest mean levels of total organic carbon occurred at WI (0.902 g 100 g^{-1}) and OB (0.898 g 100 g^{-1}) in July 2004 (Figure 12d). A decrease followed on subsequent sampling dates at both sites with a slight increase in April 2005 (0.566 g 100 g^{-1} at OB and 0.624 g 100 g^{-1} at WI). High levels of carbon were also found at HB (0.710-0.732 g 100 g^{-1}), with lower levels at TU and X, ranging from 0.358-0.482 g 100 g^{-1}. Levels of carbon were relatively consistent at HB, TU and X over the one year study period.

Levels of total nitrogen consistently increased over the study period at WI, from 0.06 g 100 g^{-1} in July 2004 to 0.134 g 100 g^{-1} in April 2005 (Figure 12e). It should be noted the standard error was high in April 2005 (0.05), and that the increase in nitrogen from January to April 2005 is probably not statistically significant. In contrast to WI, nitrogen levels at OB gradually declined overall (from 0.124 g 100 g^{-1} in July 2004 to 0.092 g 100 g^{-1} in January 2005), with consistent levels over the last two sampling dates in January and April 2005. Total nitrogen levels increased slightly at X and TU, and were consistently lower at X than at the other sites.

Total organic carbon levels in Raglan (in particular HB, OB and WI) were substantially higher than in the Firth of Thames

The data are included in full in Appendix 5.

3.4.4 Sediment Photosynthetic Pigment Concentration

3.4.4.1 Southern Firth of Thames

Mean chlorophyll-*a* levels were consistently highest at GC, with medium levels occurring at MI (apart from high levels in July 2004), KB and KA. The lowest levels were found at TP (Figure 11f). Chlorophyll-*a* levels remained much the same at both GC (17.0-18.0 mg kg^{-1}) and KA (7.7-9.9). At MI chlorophyll-*a* levels decreased from a peak of 20.3 mg kg^{-1} in July 2004 to 6.9-9.4 mg kg^{-1} on subsequent sampling dates. At

KB and TP chlorophyll-*a* levels were relatively consistent, with levels being lowest at TP.

Levels of phaeophytin in the sediment peaked in April 2005 at sites KA, KB, and GC (Figure 11g). The most marked increase occurred at KA, where levels increased from 3 mg kg^{-1} in October 2004, to 10.8 mg kg^{-1} in April 2005. At MI a peak in phaeophytin occurred in July 2004 (11.6 mg kg^{-1}), with a subsequent decrease to 1.0 mg kg^{-1} in January 2005, followed by a second lesser peak in April 2005 (3.6 mg kg^{-1}). Like most sediment variables (except total nitrogen) phaeophytin was consistent over the study period at TP.

The data are included in full in Appendix 5.

3.4.4.2 Whaingaroa (Raglan) Harbour

Mean chlorophyll-*a* concentrations in Raglan Harbour were consistently greater than those found in the Firth of Thames (with the exception of GC). Levels were relatively consistent at all sites except WI (Figure 12f), where there was a gradual increase peaking in January 2005 (21.7 mg kg^{-1}), followed by a decrease in April 2005 (to 15.9 mg kg^{-1}). Highest chlorophyll-*a* concentrations occurred at TU (23.8-25.2 mg kg^{-1}), and lowest levels at OB (11.9-14.7 mg kg^{-1}).

At HB, OB, WI and TU phaeophytin levels peaked in April 2005 (Figure 12g). In comparison, levels at site X were relatively consistent.

The data are included in full in Appendix 6.

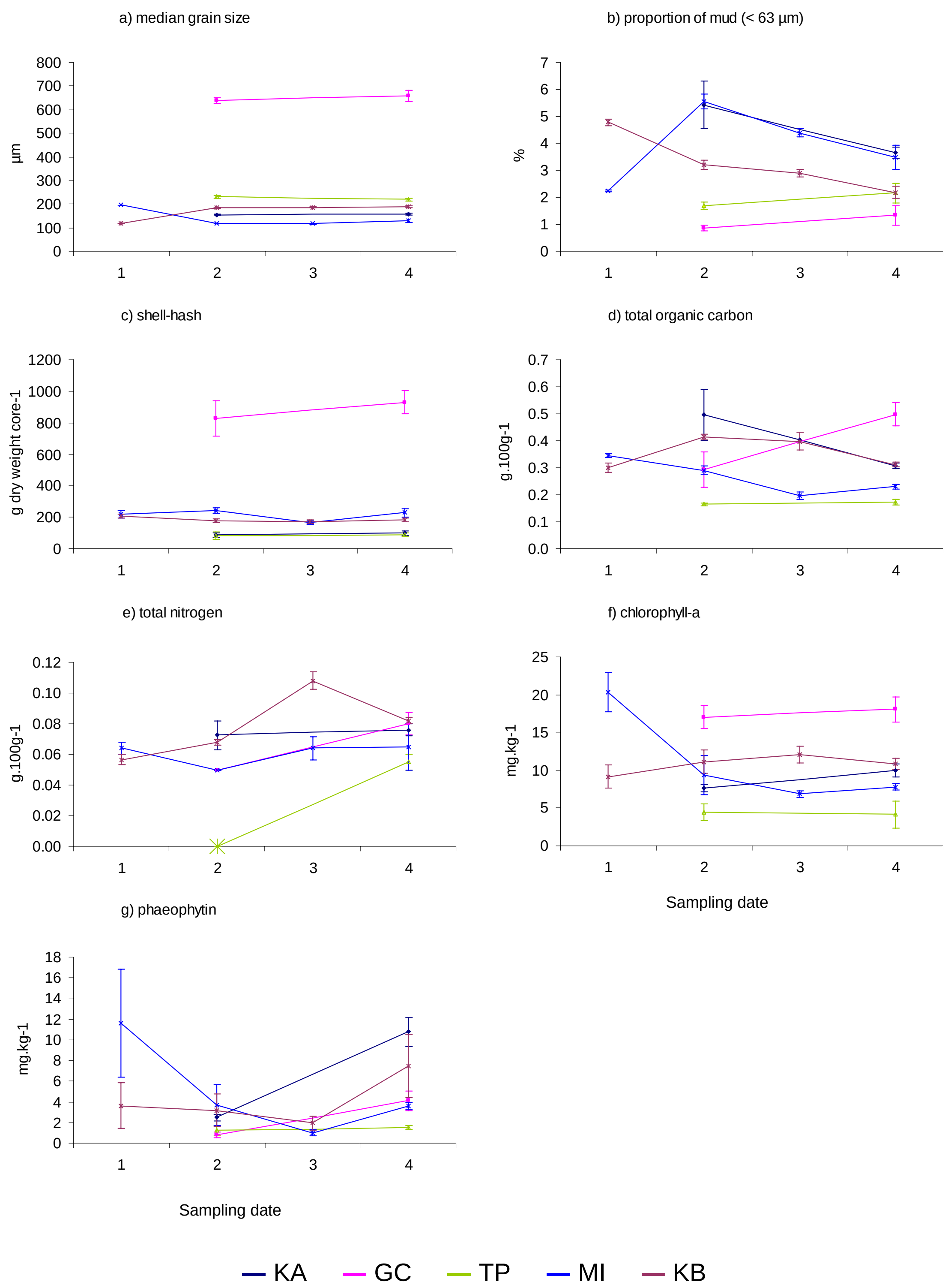

Figure 11: **Mean (± standard error) a) median grain-size, b) proportion of mud (< 63 µm), c) shell-hash dry weight, d) total organic carbon content, e) total nitrogen content ✳= < 0.05, f) chlorophyll-*a* concentration and g) phaeophytin concentration of the sediment at the permanent monitoring sites in the southern Firth of Thames between July 2004 and April 2005. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4. Note the different scales on the vertical axis.**

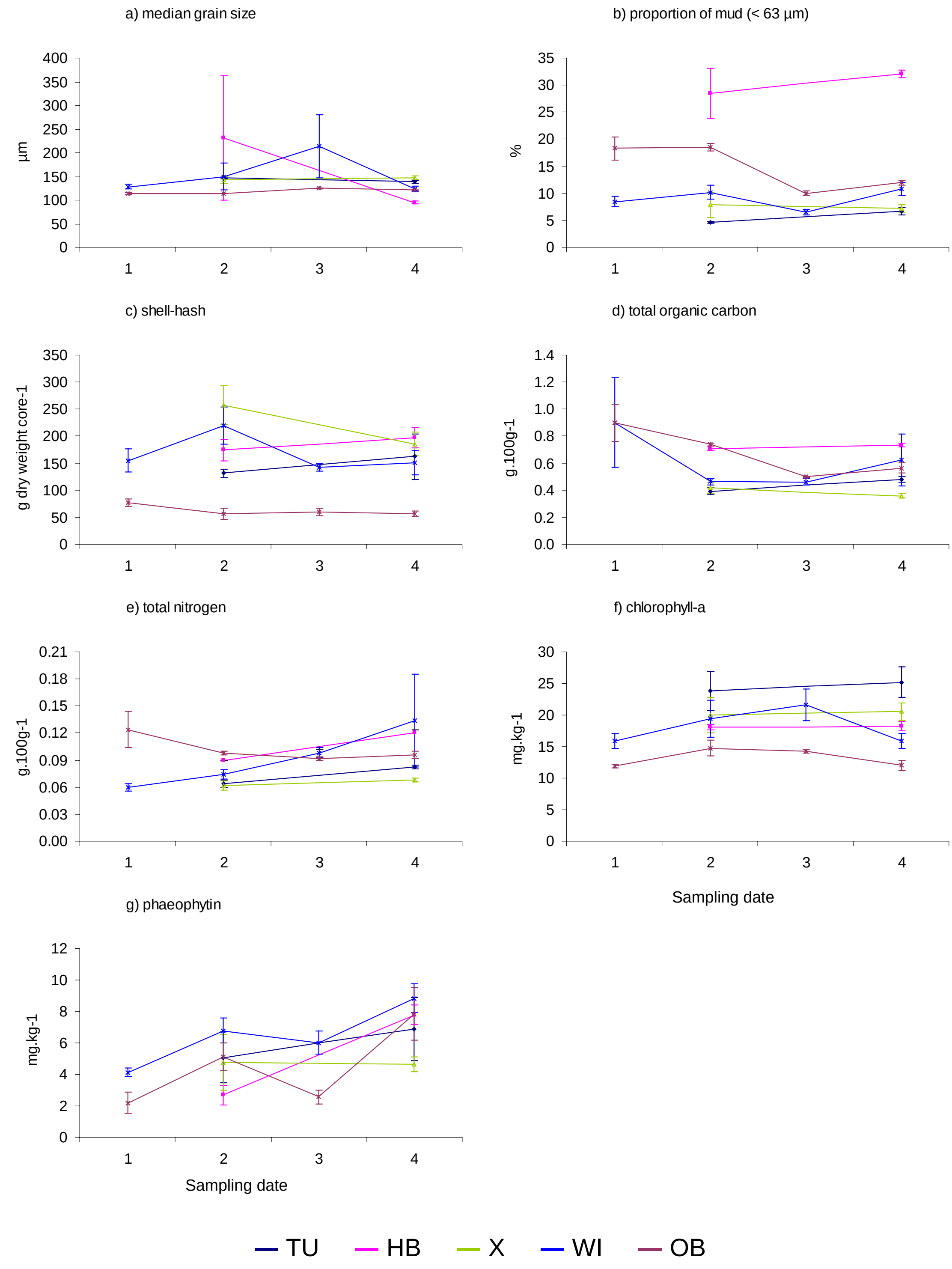

Figure 12: **Mean (± standard error) a) median grain-size, b) proportion of mud (< 63 µm), c) shell-hash dry weight, d) total organic carbon content, e) total nitrogen content, f) chlorophyll-*a* concentration and g) phaeophytin concentration of the sediment at the permanent monitoring sites in Whaingaroa Harbour between July 2004 and April 2005. Sampling dates: Jul 04 = 1, Oct 04 = 2, Jan 05 = 3, Apr 05 = 4. Note the different scales on the vertical axis.**

3.5 Linking Assemblage Composition to Sediment Characteristics

The intent of the Regional Estuary Monitoring Programme is to document existing environmental conditions (e.g., sediment grain-size, organic matter content, plant photosynthetic pigments), how these change in space and time, and to link these changes with changes in the benthic macrofauna communities. Such an integrated monitoring programme is more responsive to detecting overall trends. However, it is important to note that the linking of patterns in the benthic macrofauna assemblages to those of the measured sediment characteristics does not necessarily mean that the sediment characteristics are the cause of, or explain, the full ecological pattern. However, the sediment characteristics may be influencing the macrofauna assemblages. Causality can only be demonstrated by manipulative field or laboratory experiments, where the effects of a single factor on community structure is investigated whilst all other factors are held constant or controlled (Clarke and Warwick, 2001).

3.5.1 Southern Firth of Thames

Shell-hash was found to be the single sediment variable which best explained the patterns of macrofauna assemblage composition (Spearman rank correlation coefficient ρ_s = 0.708). Shell-hash and the grain size fraction of 500-1000 µm was the best 2-sediment variable found (ρ_s = 0.758). This was the highest correlation attained in the PRIMER BIO-ENV analysis. The best 3-sediment variable combination also included shell-hash and 500-1000 µm grain size fraction, with the addition of >1000 µm grain size fraction (ρ_s = 0.743

3.5.2 Whaingaroa (Raglan) Harbour

The grain size fraction 500-1000 µm was found to be the single sediment variable which best explained the patterns of macrofauna assemblage composition (Spearman rank correlation coefficient (ρ_s = 0.582). The best 2-sediment variable combination was the proportion of mud (grain size < 62.5 µm) and the grain size fraction 500-1000 µm (ρ_s = 0.582). The best 3-sediment variable combination included proportion of mud and grain size fraction 500-1000 µm, with the addition of chlorophyll-*a* (ρ_s = 0.771). The highest correlation found in the BIO-ENV analysis was from a 5-sediment variable combination, which included grain size fraction 500-1000 µm, proportion of mud, chlorophyll-*a*, shell-hash and phaeophytin (ρ_s = 0.783).

3.6 Southern Firth of Thames Sediment Bed Level

The sediment bed levels from April 2003 to April 2005 are reported below.

3.6.1 Kaiaua

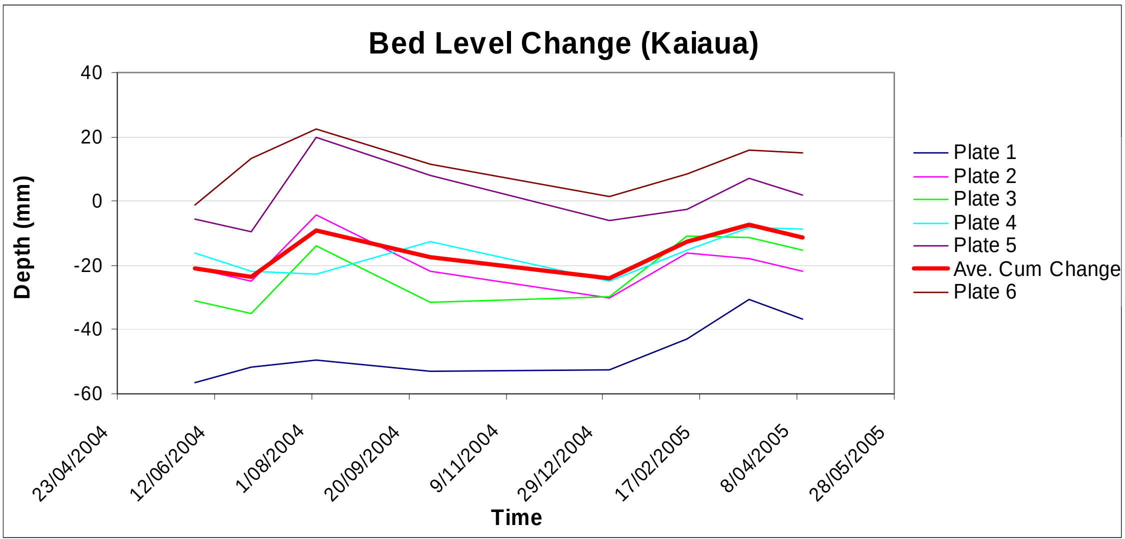

Figure 13: Cumulative change in sediment level at Kaiaua over the period April 2003 to April 2005.

Cumulative sediment level changes for this monitoring site for the period May 2004 to April 2005 are shown in Figure 13. Averaged bed levels as described in Felsing *et al.* (2006) initially declined over the period April 2002 to 2004, however a recovery of 26.4 mm occurred from April 2004 to 2005. Despite this, bed levels measured at individual sampling plates continue to show high variability (reflecting possible wave re-suspension and mixing of surficial deposits to depths of ~ 3-5 cm), with levels for plate 1 (closest to shore) showing the least variability and a consistent trend of sediment accumulation over the monitoring period. The cumulative bed levels show an overall accretion of 9.9 mm of sediment since May 2004.

3.6.2 Miranda

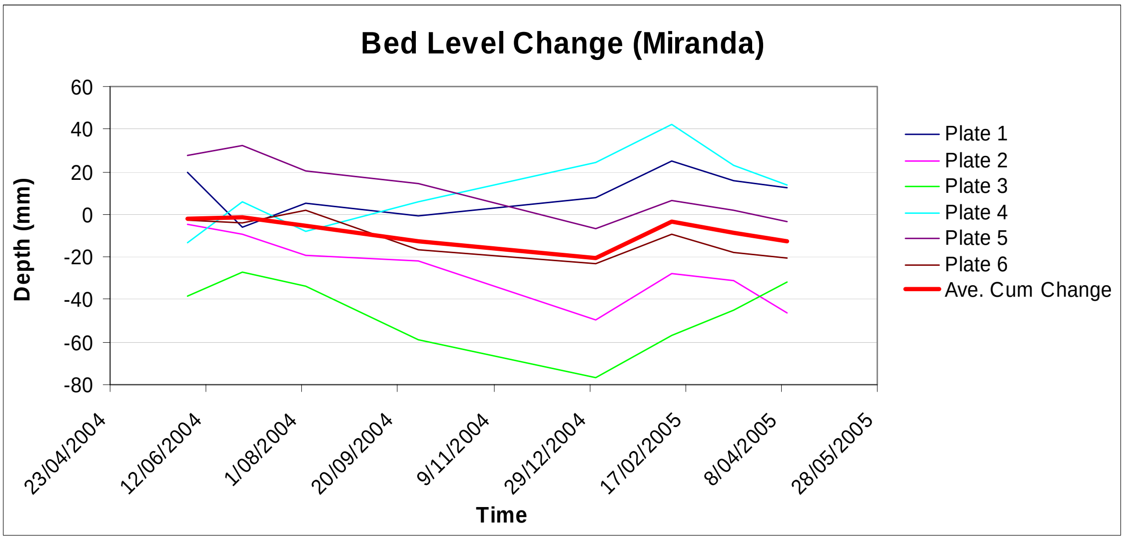

Figure 14: Cumulative change in sediment level at Miranda over the period April 2003 to April 2005

The average cumulative change (Figure 14) recorded for the monitoring period May 2004 to April 2005 continues a previous trend observed for this site (Felsing *et al*., 2006) with a sediment loss of 4.7 mm over the 12 month period ending April 05. Despite this, averaged bed levels for the site showed a slight recovery from October 2004 through to February 2005, in spite of the small fluctuations evident in the data over this period. Plate 6 (furthest off shore) tended to approximate the averaged data with recorded sediment levels across the plates being generally consistent with each other.

3.6.3 Gun Club

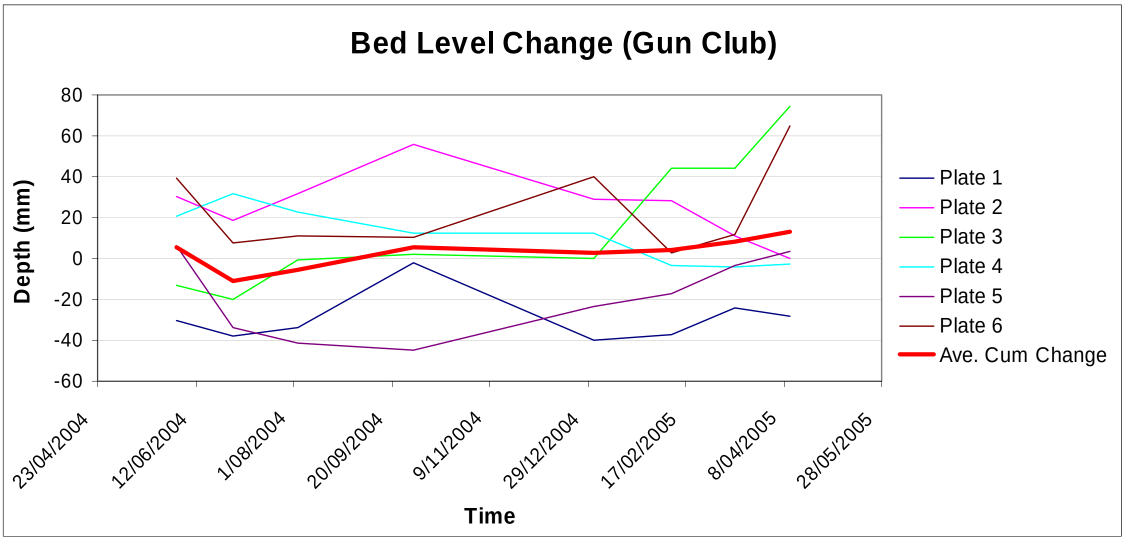

Figure 15: Cumulative change in sediment level at the Gun Club site over the period April 2003 to April 2005

Bed level changes (Figure 15) recorded at individual sediment plates within this site showed considerable variability compared with the averaged data. The averaged data indicated an overall increase in sediment depth of 12 mm for the year ending April 2005. The data at this site show considerable variability that may be related to the site's proximity to the Waihou River mouth.

3.6.4 Kuranui Bay (Tararu)

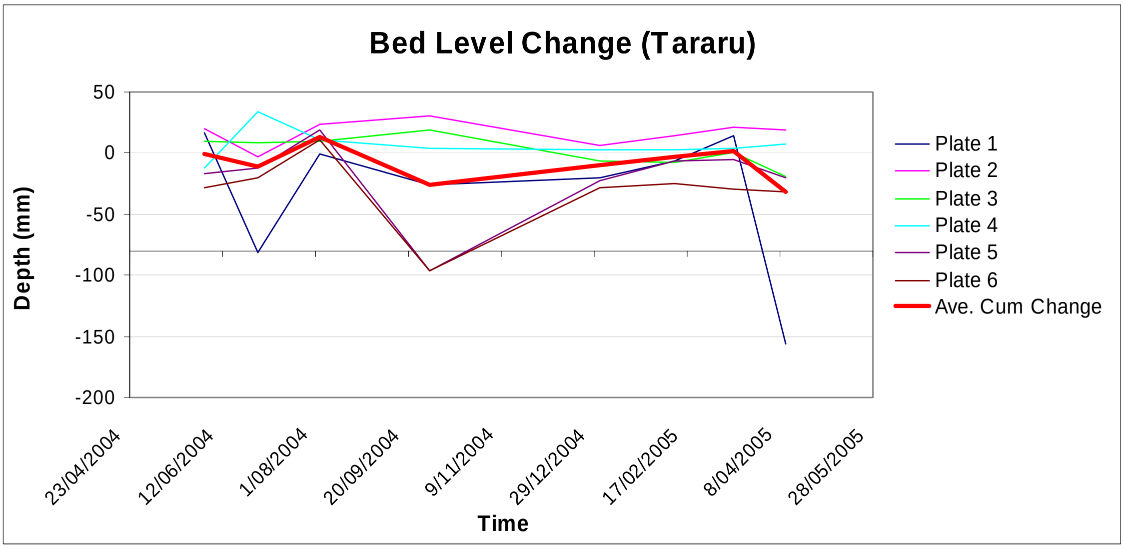

Figure 16: Cumulative change in sediment level at the Gun Club site over the period April 2003 to April 2005

Figure 16 shows the cumulative changes in bed level recorded for the measuring plates at Tararu. The averaged cumulative change data for the 12 month period ending April 2005 indicate a reduction in bed level of 9.3 mm. The data for the site show considerable variability between plates, potentially caused by wave ripples and tidal scour channels evident in the surficial fine grained sediments found at this site.

4 Discussion

This report documents the data from July 2004 to April 2005 of the monitoring programme. Detailed discussion and analysis of trends or patterns of change over time in the benthic macrofaunal communities and sediment characteristics will be reported on every five years in a separate trend report series for the Regional Estuary Monitoring Programme. At present we are building up a picture of short-term changes (their nature, size and frequency) that affect these communities. In the future, information on these changes will enable long-term trends to be identified. It is in such trends that any impacts of long-term changes in the estuaries or their catchments are likely to become apparent.

The Regional Estuary Monitoring Programme will continue as outlined in Turner (2001). Monitoring will be undertaken at two of the sites in each estuary at 3-monthly intervals (January, April, July and October) and at the three remaining sites at 6-monthly intervals (April and October) (Table 10 and Table 11).

Table 10: Past and planned future 3- and 6-monthly sampling schedule at the five permanent monitoring sites in the southern Firth of Thames.

	KA	MI	GC	KB	TP
2001	Apr/Oct	Apr/July/Oct	Apr/Oct	Apr/July/Oct	Apr/Oct
2002	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2003	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2004	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2005	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2006	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct

Table11: Past and planned future 3- and 6-monthly sampling schedule at the five permanent monitoring sites in Whaingaroa Harbour.

	KA	MI	GC	KB	TP
2001	Apr/Oct	Apr/July/Oct	Apr/Oct	Apr/July/Oct	Apr/Oct
2002	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2003	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2004	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2005	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct
2006	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct	Jan/Apr/July/Oct	Apr/Oct

A review of the monitoring programme will be undertaken in 2006/2007 to assess whether any changes can be implemented in terms of frequency of sampling or the number of sites sampled, and/or the number of samples collected on each sampling occasion.

Continued monitoring will provide a measure of the patterns of temporal change in the sediment characteristics and the associated benthic communities. From these time-series it will be possible to distinguish trends from short-term variability, and thereby identify long-term changes in the sediment and benthic communities.

Rather than focusing on monitoring one or two species ("indicator species") which are presumed to be representative of the whole community in terms of their response to environmental changes, the Regional Estuary Monitoring Programme monitors a suite of 26 selected benthic macrofauna species and taxa.

With the exception of the exotic bivalve species, *Musculista senhousia*, at KA, GC and MI on April 2005, the majority of species/taxa recorded at each of the monitoring sites are included in this suite of monitored taxa with non-indicator species making relatively small contributions numerically to the macrofauna communities (see Figure 4 and Figure 5).

Examination of the non-monitored species/taxa at sites in both the southern Firth of Thames and Whaingaroa Harbour has identified some species/taxonomic groups which occurred in high numbers. For example the non-indicator gastropod species *Cominella glandiformis* is more common in Firth of Thames samples than the indicator gastropod *Cominella adspersa*. It should also be noted the indicator polychaetes *Aglaophamus* sp. and *Glycera* sp. are very rare in both Raglan Harbour and Firth of Thames. Over the four years of sampling in both harbours from April 2001 to April 2005 only a total of 66 *Aglaophamus* individuals were found. At this stage it is not proposed that changes to the list of monitored species should be implemented. However, it is important that the non-monitored species should continue to be identified (at least to taxonomic group) and counted to provide a broad description of the changes in macrofauna communities occurring at each site. This will provide a fuller description of the macrofauna communities and be useful in identifying potential incursions of introduced species such as *Musculista senhousia*.

In the long term, maintenance of the current monthly sediment level monitoring programme may not be possible. The upcoming analysis report will consider altering the sampling pattern to include short periods of relatively intensive monitoring, interspersed with periods of no monitoring. This would provide relatively accurate measurements of sediment level during each monitoring period and allow determination of changes between these monitoring cycles. Moreover it would be useful to link the bed level monitoring data to estuary hydrodynamics using the three dimensional model of the Firth of Thames (Stephens, 2003) to see whether the patterns observed in the sediment data can be explained in terms of various forcing conditions (such as wind, tides and river flows) and hydrodynamic conditions occurring in the Firth

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Appendix 1 - Southern Firth of Thames species/taxonomic group abundances

KA October 2004

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		1	0	0	0	0	0	0	0	0	2	0	0	**3**	**0.3**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	7	0	4	0	0	0	2	0	3	0	2	**18**	**1.5**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	7	0	4	0	0	0	2	0	3	0	2	**18**	**1.5**
BAS	*Austrovenus stutchburyi*	<5	3	0	1	1	1	0	0	0	0	0	0	0	**6**	**0.5**
		>5	2	1	0	1	0	0	1	0	0	1	0	1	**7**	**0.6**
		Cond.analysis	0	0	1	1	0	0	0	0	1	0	0	0	**3**	**0.3**
		Total	5	1	2	3	1	0	1	0	1	1	0	1	**16**	**1.3**
BML	*Macamona liliana*	<5	2	1	11	4	10	5	3	1	1	1	2	1	**42**	**3.5**
		5-15	0	1	1	2	1	2	2	0	1	0	3	1	**14**	**1.2**
		>15	0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.1**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	2	2	12	6	11	7	6	1	2	1	5	2	**57**	**4.8**
BNH	*Nucula hartvigiana*	<2	9	26	13	13	25	15	10	17	8	8	18	9	**171**	**14.3**
		>2	24	41	58	25	24	32	38	46	30	52	15	34	**419**	**34.9**
		Total	33	67	71	38	49	47	48	63	38	60	33	43	**590**	**49.2**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	1	0	1	0	0	0	0	0	0	3	0	0	**5**	**0.4**
		>5	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.1**
		Total	1	0	2	0	0	0	0	0	0	3	0	0	**6**	**0.5**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	2	0	1	1	0	1	1	1	0	0	1	**8**	**0.7**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	1	0	0	0	0	1	**2**	**0.2**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		5	3	0	0	0	0	0	0	0	0	0	0	**8**	**0.7**
PAGL	*Aglaophamus* sp.		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PAO	*Aonides oxycephala*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAR	*Aricidea* sp.		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
PBOC	Pseudopolydora complex		4	2	0	3	2	2	0	1	1	0	0	0	**15**	**1.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		1	3	2	2	1	1	1	0	0	0	0	0	**11**	**0.9**
PGLY	*Glycera* sp.		0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PHF	"Capitellidae"		45	15	13	7	12	11	2	10	5	20	8	11	**159**	**13.3**
PMD	*Magelona dakini*		1	0	1	2	1	2	2	3	0	0	2	4	**18**	**1.5**
PNIC	Nereidae		3	5	1	2	2	0	0	0	0	3	0	1	**17**	**1.4**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	1	0	0	1	1	0	1	0	0	**4**	**0.3**
CCRAB	Crabs		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
COST	Ostracods		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	2	**2**	**0.2**
COTH	Other Crustaceans		0	0	0	0	0	0	2	0	0	0	0	0	**2**	**0.2**
BOTH	Bivalves		1	0	7	3	9	6	2	2	3	8	7	3	**51**	**4.3**
GOTH	Gastropods		1	0	1	0	0	0	0	0	0	2	0	0	**4**	**0.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	3	0	0	0	0	1	0	0	0	0	1	**5**	**0.4**
POTH	Polychaetes		0	0	2	2	0	1	3	1	1	0	1	0	**11**	**0.9**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		9	7	0	2	0	0	1	0	0	3	0	0	**22**	**1.8**
TOTAL			**114**	**118**	**115**	**77**	**89**	**77**	**72**	**85**	**53**	**107**	**56**	**72**	**1035**	**86.3**

KA April 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	1	1	2	0	1	5	0	3	0	7	0	1	**21**	**1.8**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	1	2	0	1	5	0	3	0	7	0	1	**21**	**1.8**
BAS	*Austrovenus stutchburyi*	<5	35	77	57	54	69	50	58	54	51	80	62	55	**702**	**58.5**
		>5	1	0	8	8	3	0	5	0	1	2	0	1	**29**	**2.4**
		Cond.analysis	0	0	0	3	0	0	2	0	3	0	0	1	**9**	**0.8**
		Total	36	77	65	65	72	50	65	54	55	82	62	57	**740**	**61.7**
BML	*Macamona liliana*	<5	2	1	2	2	3	2	0	3	1	2	2	2	**22**	**1.8**
		5-15	2	1	1	2	0	1	2	2	0	2	1	0	**14**	**1.2**
		>15	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
		Cond.analysis	0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.1**
		Total	4	2	3	4	3	4	3	5	1	4	3	2	**38**	**3.2**
BNH	*Nucula hartvigiana*	<2	23	49	17	14	40	33	45	44	32	49	49	31	**426**	**35.5**
		>2	96	51	49	39	53	80	77	66	51	70	63	64	**759**	**63.3**
		Total	119	100	66	53	93	113	122	110	83	119	112	95	**1185**	**98.8**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
		Total	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
BTHL	*Theora lubrica*	<5	1	11	10	1	2	11	1	0	4	4	2	1	**48**	**4.0**
		>5	0	0	1	3	0	2	1	2	1	0	7	0	**17**	**1.4**
		Total	1	11	11	4	2	13	2	2	5	4	9	1	**65**	**5.4**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	1	2	1	0	1	1	1	1	2	2	0	**12**	**1.0**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		1	0	0	1	1	0	3	1	0	1	0	0	**8**	**0.7**
PAGL	*Aglaophamus* sp.		0	0	0	0	1	1	3	0	0	1	1	2	**9**	**0.8**
PAO	*Aonides oxycephala*		0	0	0	0	0	3	0	0	0	0	0	0	**3**	**0.3**
PAR	*Aricidea* sp.		3	0	0	0	2	1	0	0	0	0	0	0	**6**	**0.5**
PBOC	Pseudopolydora complex		1	0	1	0	1	1	1	1	2	0	0	9	**17**	**1.4**
PCOS	*Cossura* sp.		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PHF	"Capitellidae"		13	14	48	21	20	33	19	17	47	27	31	28	**318**	**26.5**
PMD	*Magelona dakini*		5	3	9	4	6	3	3	5	6	8	6	13	**71**	**5.9**
PNIC	Nereidae		2	4	15	8	3	4	3	2	6	8	3	3	**61**	**5.1**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	1	0	0	0	0	0	2	0	0	0	2	**5**	**0.4**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	2	0	0	0	1	0	1	0	0	**4**	**0.3**
CCRAB	Crabs		1	1	0	0	0	1	0	0	3	0	1	0	**7**	**0.6**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	1	0	0	1	0	0	1	1	0	0	1	**5**	**0.4**
COST	Ostracods		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
CSHR	Shrimps/Mysids		0	1	0	1	0	0	1	1	0	0	0	0	**4**	**0.3**
COTH	Other Crustaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BOTH	Bivalves		48	19	50	179	117	70	109	39	33	134	38	23	**859**	**71.6**
GOTH	Gastropods		0	0	1	1	0	0	1	0	0	0	0	1	**4**	**0.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	1	0	1	2	0	0	0	1	1	0	0	**7**	**0.6**
POTH	Polychaetes		1	0	0	0	0	1	0	0	1	1	0	0	**4**	**0.3**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		0	0	0	0	0	0	2	0	0	0	0	0	**2**	**0.2**
TOTAL			**238**	**238**	**273**	**346**	**326**	**305**	**338**	**245**	**245**	**400**	**268**	**238**	**3460**	**288.3**

GC October 2004

INDICATOR SPECIES		SIZE	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
			CORE NUMBER													
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	0	0	0	1	0	0	0	0	2	0	**3**	**0.3**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	1	0	0	0	0	2	0	**3**	**0.3**
BAS	*Austrovenus stutchburyi*	<5	0	0	2	0	0	0	1	0	0	1	0	0	**4**	**0.3**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	2	0	0	0	1	0	0	1	0	0	**4**	**0.3**
BML	*Macamona liliana*	<5	0	0	0	1	0	0	0	1	0	0	1	0	**3**	**0.3**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	1	0	0	0	2	0	0	1	0	**4**	**0.3**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	1	0	0	1	0	1	0	**3**	**0.3**
		>2	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
		Total	0	0	0	0	0	1	0	1	1	0	1	0	**4**	**0.3**
BPA	*Paphies australis*	<5	21	15	33	42	67	29	14	10	5	8	12	13	**269**	**22.4**
		5-15	6	1	3	5	6	2	2	0	2	2	1	0	**30**	**2.5**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	27	16	36	47	73	31	16	10	7	10	13	13	**299**	**24.9**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		1	5	1	4	9	5	2	8	3	1	8	3	**50**	**4.2**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		242	159	129	47	61	82	23	216	77	123	232	142	**1533**	**127.8**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		1	0	0	0	0	0	0	1	0	1	0	0	**3**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
PHF	"Capitellidae"		6	4	0	3	1	1	0	0	2	0	1	3	**21**	**1.8**
PMD	*Magelona dakini*		1	0	0	0	0	0	0	1	0	0	1	1	**4**	**0.3**
PNIC	Nereidae		0	3	0	1	0	2	0	0	0	0	2	1	**9**	**0.8**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	1	0	0	0	0	0	0	0	1	0	**2**	**0.2**
CCRAB	Crabs		0	0	0	0	1	0	0	0	0	0	0	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	0	0	0	1	0	0	0	2	**3**	**0.3**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	2	0	0	0	0	1	0	0	0	**3**	**0.3**
COTH	Other Crustaceans		0	0	2	1	0	0	0	1	0	0	1	0	**5**	**0.4**
BOTH	Bivalves		0	1	1	2	4	5	2	1	4	2	2	1	**25**	**2.1**
GOTH	Gastropods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
ONEM	Nemerteans		4	5	1	1	1	3	0	1	0	1	3	1	**21**	**1.8**
POTH	Polychaetes		19	16	21	10	24	27	3	7	28	16	13	7	**191**	**15.9**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	1	0	0	0	0	3	1	1	8	0	**14**	**1.2**
OTHER	Misc. Other (nematoda)		1	0	4	8	0	1	0	7	0	0	6	2	**29**	**2.4**
TOTAL			**302**	**209**	**199**	**127**	**174**	**159**	**47**	**260**	**125**	**156**	**295**	**177**	**2229**	**185.8**

GC April 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	1	8	1	2	0	0	0	0	0	0	0	**12**	**1.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	1	8	1	2	0	0	0	0	0	0	0	**12**	**1.0**
BAS	*Austrovenus stutchburyi*	<5	1	3	11	4	8	10	9	8	7	1	2	10	**74**	**6.2**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	1	0	3	0	0	0	0	0	0	0	1	0	**5**	**0.4**
		Total	2	3	14	4	8	10	9	8	7	1	3	10	**79**	**6.6**
BML	*Macamona liliana*	<5	0	1	0	0	0	1	0	0	0	0	0	0	**2**	**0.2**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	1	0	0	0	1	0	0	0	0	0	0	**2**	**0.2**
BNH	*Nucula hartvigiana*	<2	1	0	1	2	3	0	0	0	1	1	0	0	**9**	**0.8**
		>2	0	0	0	0	0	2	0	0	0	0	0	1	**3**	**0.3**
		Total	1	0	1	2	3	2	0	0	1	1	0	1	**12**	**1.0**
BPA	*Paphies australis*	<5	21	3	2	8	2	7	0	5	0	13	16	4	**81**	**6.8**
		5-15	3	4	1	3	0	8	2	1	2	0	8	0	**32**	**2.7**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	24	7	3	11	2	15	2	6	2	13	24	4	**113**	**9.4**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		3	1	1	0	2	0	0	0	0	4	0	1	**12**	**1.0**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	1	0	1	0	1	0	1	0	0	**4**	**0.3**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	1	0	0	0	0	1	**2**	**0.2**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		101	293	268	193	287	373	142	293	54	193	181	183	**2561**	**213.4**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		0	0	1	0	0	0	0	1	0	0	0	0	**2**	**0.2**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PHF	"Capitellidae"		2	14	1	4	3	3	3	14	0	3	1	4	**52**	**4.3**
PMD	*Magelona dakini*		0	0	0	1	0	0	0	1	0	0	1	1	**4**	**0.3**
PNIC	Nereidae		3	3	2	4	7	6	6	2	1	3	2	0	**39**	**3.3**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	1	0	0	0	0	0	0	0	0	1	**2**	**0.2**
CCRAB	Crabs		0	1	0	0	1	1	1	0	0	0	1	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		4	11	4	15	14	27	16	5	7	12	17	15	**147**	**12.3**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	1	0	0	0	1	0	0	0	0	0	0	**2**	**0.2**
BOTH	Bivalves		29	19	36	19	10	70	18	28	19	7	34	17	**306**	**25.5**
GOTH	Gastropods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	1	0	1	1	1	2	1	1	1	1	0	**10**	**0.8**
POTH	Polychaetes		13	15	6	9	17	26	11	18	12	10	32	13	**182**	**15.2**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	1	4	2	2	4	1	3	3	0	1	2	**23**	**1.9**
OTHER	Misc. Other (nematoda)		37	24	0	13	4	16	0	13	1	1	45	1	**155**	**12.9**
TOTAL			**219**	**396**	**350**	**280**	**363**	**557**	**212**	**394**	**108**	**250**	**344**	**254**	**3722**	**310.2**

TP October 2004

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	0	0	0	0	0	0	1	0	1	0	**2**	**0.2**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	1	0	1	0	**2**	**0.2**
BAS	*Austrovenus stutchburyi*	<5	0	0	0	0	1	1	0	1	1	1	0	0	**5**	**0.4**
		> 5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	1	0	0	1	0	**2**	**0.2**
		Total	0	0	0	0	1	1	0	2	1	1	1	0	**7**	**0.6**
BML	*Macamona liliana*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		> 15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BNH	*Nucula hartvigiana*	<2	22	3	14	47	16	47	16	31	52	36	23	8	**315**	**26.3**
		>2	13	17	7	24	15	32	10	15	18	23	24	3	**201**	**16.8**
		Total	35	20	21	71	31	79	26	46	70	59	47	11	**516**	**43.0**
BPA	*Paphies australis*	<5	0	14	224	2	0	0	0	0	1	0	1	3	**245**	**20.4**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		> 15	5	0	0	0	0	0	0	1	0	0	1	0	**7**	**0.6**
		Cond.analysis	0	1	0	18	30	7	31	27	23	28	24	0	**189**	**15.8**
		Total	5	15	224	20	30	7	31	28	24	28	26	3	**441**	**36.8**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	0	0	2	0	1	0	1	0	1	**5**	**0.4**
GASTROPODS																
GCA	*Cominella adspera*		0	2	0	0	0	0	0	0	1	0	0	0	**3**	**0.3**
GNHE	*Notoacmea* sp.		1	0	0	0	0	0	0	1	0	0	0	0	**2**	**0.2**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		4	1	0	0	0	0	0	0	1	0	0	1	**7**	**0.6**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		2	5	0	2	0	4	8	28	2	9	6	1	**67**	**5.6**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
PHF	"Capitellidae"		10	0	0	3	1	2	0	1	1	0	0	4	**22**	**1.8**
PMD	*Magelona dakini*		2	1	1	0	0	0	0	0	0	0	0	2	**6**	**0.5**
PNIC	Nereidae		0	0	0	0	0	0	1	0	0	0	0	1	**2**	**0.2**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CCRAB	Crabs		0	0	0	0	0	0	0	0	0	0	1	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
COST	Ostracods		31	0	0	0	0	3	0	2	0	0	0	0	**36**	**3.0**
CSHR	Shrimps/Mysids		0	0	0	1	0	0	0	0	0	1	0	0	**2**	**0.2**
COTH	Other Crustaceans		0	0	0	0	0	0	0	0	2	0	0	0	**2**	**0.2**
BOTH	Bivalves		0	2	5	1	0	0	1	1	0	4	1	0	**15**	**1.3**
GOTH	Gastropods		0	1	6	1	1	3	3	3	5	2	2	0	**27**	**2.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
POTH	Polychaetes		13	1	0	1	0	0	0	0	1	3	0	0	**19**	**1.6**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		5	2	3	0	14	1	5	12	0	3	1	4	**50**	**4.2**
TOTAL			**109**	**50**	**260**	**101**	**79**	**102**	**75**	**125**	**110**	**111**	**86**	**29**	**1236**	**103.0**

TP April 2005

INDICATOR SPECIES		SIZE	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
			CORE NUMBER													
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	2	0	0	0	0	**2**	**0.2**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BAS	*Austrovenus stutchburyi*	<5	15	9	4	8	5	5	4	7	4	19	16	11	**107**	**8.9**
		> 5	2	0	0	0	0	0	0	2	0	2	0	0	**6**	**0.5**
		Cond.analysis	0	0	0	1	1	0	0	0	0	0	1	0	**3**	**0.3**
		Total	17	9	4	8	5	5	4	9	4	21	16	11	**113**	**9.4**
BML	*Macamona liliana*	<5	0	0	0	0	0	0	0	9	0	0	0	0	**9**	**0.8**
		5-15	0	0	0	0	0	0	0	2	0	0	0	0	**2**	**0.2**
		> 15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	11	0	0	0	0	**11**	**0.9**
BNH	*Nucula hartvigiana*	<2	18	7	9	13	10	12	6	15	9	16	6	15	**136**	**11.3**
		>2	48	13	30	27	46	35	9	68	52	17	17	28	**390**	**32.5**
		Total	66	20	39	40	56	47	15	83	61	33	23	43	**526**	**43.8**
BPA	*Paphies australis*	<5	0	1	1	0	2	0	1	255	0	0	7	0	**267**	**22.3**
		5-15	0	0	0	0	0	0	0	7	0	0	0	0	**7**	**0.6**
		> 15	0	0	0	1	0	0	0	0	0	0	0	1	**2**	**0.2**
		Cond.analysis	18	1	20	29	10	7	27	2	17	27	3	31	**192**	**16.0**
		Total	18	2	21	30	12	7	28	264	17	27	10	32	**468**	**39.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		1	0	1	0	0	0	0	4	0	0	1	2	**9**	**0.8**
GASTROPODS																
GCA	*Cominella adspera*		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
GNHE	*Notoacmea* sp.		2	0	0	0	0	0	0	0	0	0	0	0	**2**	**0.2**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	3	0	0	0	0	0	6	1	0	4	14	**28**	**2.3**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		5	8	0	0	3	0	0	5	1	0	0	0	**22**	**1.8**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
PHF	"Capitellidae"		1	2	0	0	0	0	0	6	1	0	1	1	**12**	**1.0**
PMD	*Magelona dakini*		0	0	0	0	0	2	0	7	0	0	3	0	**12**	**1.0**
PNIC	Nereidae		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	3	0	0	3	0	0	0	1	0	0	0	**7**	**0.6**
CCRAB	Crabs		1	1	0	0	0	2	1	0	1	0	1	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		1	2	0	0	1	4	0	2	2	1	0	0	**13**	**1.1**
COST	Ostracods		0	0	1	0	2	0	1	0	0	0	0	1	**5**	**0.4**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	0	1	0	0	0	1	1	0	0	0	**3**	**0.3**
BOTH	Bivalves		0	2	1	1	3	0	2	47	0	1	12	2	**71**	**5.9**
GOTH	Gastropods		0	0	0	0	2	0	0	0	0	0	0	0	**2**	**0.2**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	2	0	0	2	0	0	0	0	0	0	0	**4**	**0.3**
POTH	Polychaetes		0	5	0	0	2	0	0	10	1	0	12	1	**31**	**2.6**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		85	6	12	40	4	12	30	24	16	21	9	32	**291**	**24.3**
TOTAL			**198**	**65**	**79**	**120**	**95**	**79**	**81**	**481**	**107**	**104**	**92**	**141**	**1635**	**136.3**

MI July 2004

INDICATOR SPECIES			CORE NUMBER												TOTAL	MEAN
			1	2	3	4	5	6	7	8	9	10	11	12		
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	1	1	0	1	1	0	2	6	0	1	0	0	**13**	**1.1**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	1	0	1	1	0	2	6	0	1	0	0	**13**	**1.1**
BAS	*Austrovenus stutchburyi*	<5	2	4	4	0	2	3	1	2	4	2	5	3	**32**	**2.7**
		>5	2	2	1	0	1	1	0	1	11	1	1	1	**22**	**1.8**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	4	6	5	0	3	4	1	3	15	3	6	4	**54**	**4.5**
BML	*Macamona liliana*	<5	0	2	3	1	4	4	3	6	6	2	7	0	**38**	**3.2**
		5-15	0	2	2	1	0	1	0	3	0	0	2	0	**11**	**0.9**
		>15	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	4	5	2	4	5	3	9	7	2	9	0	**50**	**4.2**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
		Total	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	1	1	0	0	2	0	0	2	2	0	2	**10**	**0.8**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		1	1	2	0	0	0	0	0	0	0	0	0	**4**	**0.3**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		19	29	38	30	1	6	18	13	63	24	15	19	**275**	**22.9**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
PGLY	*Glycera* sp.		1	0	0	0	0	1	0	1	0	1	0	1	**5**	**0.4**
PHF	"Capitellidae"		0	1	0	0	0	0	1	0	0	2	0	0	**4**	**0.3**
PMD	*Magelona dakini*		0	1	1	1	0	2	0	0	0	0	1	3	**9**	**0.8**
PNIC	Nereidae		2	1	1	0	1	2	1	0	1	0	1	0	**10**	**0.8**
POP	*Orbinia papillosa*		2	0	0	2	0	1	1	2	0	0	0	0	**8**	**0.7**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		1	0	0	0	1	2	2	1	0	0	0	0	**7**	**0.6**
CCRAB	Crabs		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	1	1	1	0	0	0	0	2	7	2	0	**14**	**1.2**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	0	1	0	1	0	0	1	0	0	0	**3**	**0.3**
BOTH	Bivalves		1	0	5	1	4	1	1	1	3	4	1	3	**25**	**2.1**
GOTH	Gastropods		0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	1	0	0	0	0	1	0	0	0	0	**2**	**0.2**
ONEM	Nemerteans		0	0	0	1	2	2	1	1	0	0	1	0	**8**	**0.7**
POTH	Polychaetes		1	0	0	2	0	0	0	0	0	0	0	1	**4**	**0.3**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
OTHER	Misc. Other		2	9	5	5	3	4	11	18	49	0	0	0	**106**	**8.8**
TOTAL			**35**	**56**	**65**	**47**	**20**	**33**	**42**	**56**	**144**	**46**	**38**	**33**	**615**	**51.3**

MI October 2004

INDICATOR SPECIES			CORE NUMBER												TOTAL	MEAN
			1	2	3	4	5	6	7	8	9	10	11	12		
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	7	0	0	1	20	2	5	0	0	0	0	**35**	**2.9**
		>2	0	0	0	0	0	2	0	0	0	0	0	0	**2**	**0.2**
		Total	0	7	0	0	1	22	2	5	0	0	0	0	**37**	**3.1**
BAS	*Austrovenus stutchburyi*	<5	2	1	0	1	1	2	3	0	1	1	2	2	**16**	**1.3**
		>5	4	0	0	2	0	3	1	1	0	1	0	1	**13**	**1.1**
		Cond.analysis	0	0	0	0	0	0	0	0	0	1	1	0	**2**	**0.2**
		Total	6	1	0	3	1	5	4	1	1	3	3	3	**31**	**2.6**
BML	*Macamona liliana*	<5	1	1	1	2	3	2	2	2	2	0	1	3	**20**	**1.7**
		5-15	0	1	1	1	0	1	1	1	1	0	0	0	**7**	**0.6**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	2	2	3	3	3	3	3	3	0	1	3	**27**	**2.3**
BNH	*Nucula hartvigiana*	<2	0	1	0	0	0	1	0	0	0	0	0	1	**3**	**0.3**
		>2	0	1	1	0	0	0	0	0	0	0	0	0	**2**	**0.2**
		Total	0	2	1	0	0	1	0	0	0	0	0	1	**5**	**0.4**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	2	0	1	0	0	0	0	0	1	1	1	**6**	**0.5**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		6	8	51	17	29	15	5	17	27	52	21	14	**262**	**21.8**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		1	3	0	0	0	0	0	0	1	1	0	0	**6**	**0.5**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		1	0	0	2	1	0	0	0	0	1	1	1	**7**	**0.6**
PHF	"Capitellidae"		5	9	0	1	1	5	0	1	2	2	0	3	**29**	**2.4**
PMD	*Magelona dakini*		0	1	1	2	0	1	0	1	3	0	2	0	**11**	**0.9**
PNIC	Nereidae		1	1	0	0	3	1	1	1	0	0	0	1	**9**	**0.8**
POP	*Orbinia papillosa*		3	4	1	2	0	6	10	4	0	2	0	1	**33**	**2.8**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
CCRAB	Crabs		0	1	0	0	0	0	0	0	0	0	0	1	**2**	**0.2**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	0	0	0	0	0	0	1	1	**2**	**0.2**
COST	Ostracods		0	2	0	0	0	0	0	0	0	0	0	0	**2**	**0.2**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	1	0	0	0	0	0	1	0	1	0	0	**3**	**0.3**
BOTH	Bivalves		0	1	0	1	0	1	0	1	0	2	0	0	**6**	**0.5**
GOTH	Gastropods		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	1	1	0	0	0	1	0	0	1	2	0	**6**	**0.5**
POTH	Polychaetes		0	0	1	0	1	0	1	0	2	7	0	2	**14**	**1.2**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		4	1	0	0	0	0	0	0	0	0	0	0	**5**	**0.4**
OEDW	*Edwardsia*		0	0	0	0	1	0	1	0	0	0	0	0	**2**	**0.2**
OTHER	Misc. Other		0	3	0	0	1	0	0	0	0	0	0	0	**4**	**0.3**
TOTAL			**28**	**50**	**58**	**34**	**43**	**60**	**28**	**35**	**39**	**73**	**32**	**32**	**512**	**42.7**

MI January 2005

INDICATOR SPECIES		SIZE	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
			CORE NUMBER													
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	3	0	**3**	**0.3**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	1	4	2	0	0	0	12	1	5	0	7	10	**42**	**3.5**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	4	2	0	0	0	12	1	5	0	7	10	**42**	**3.5**
BAS	*Austrovenus stutchburyi*	<5	1	0	1	3	4	1	2	0	0	3	0	1	**16**	**1.3**
		>5	0	1	4	0	3	0	0	0	1	2	1	1	**13**	**1.1**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	1	5	3	7	1	2	0	1	5	1	2	**29**	**2.4**
BML	*Macamona liliana*	<5	1	0	0	1	0	1	1	0	0	0	1	0	**5**	**0.4**
		5-15	3	0	1	0	0	0	0	0	0	1	2	1	**8**	**0.7**
		>15	0	0	1	0	1	0	0	0	0	0	0	0	**2**	**0.2**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	4	0	2	1	1	1	1	0	0	1	3	1	**15**	**1.3**
BNH	*Nucula hartvigiana*	<2	1	0	0	0	0	0	1	0	1	0	0	0	**3**	**0.3**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	0	0	0	0	0	1	0	1	0	0	0	**3**	**0.3**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		2	1	0	1	0	1	0	0	0	2	0	1	**8**	**0.7**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		2	1	2	3	2	1	8	7	1	7	0	3	**37**	**3.1**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		7	8	12	18	11	16	7	44	10	8	12	59	**212**	**17.7**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	1	0	0	2	0	2	0	0	0	1	1	**7**	**0.6**
PHF	"Capitellidae"		0	0	1	1	0	1	3	2	4	1	1	1	**15**	**1.3**
PMD	*Magelona dakini*		0	1	0	0	0	0	0	0	1	1	0	0	**3**	**0.3**
PNIC	Nereidae		0	1	6	2	3	4	1	3	1	1	1	6	**29**	**2.4**
POP	*Orbinia papillosa*		6	5	3	0	6	5	0	2	8	1	4	0	**40**	**3.3**
PPAR	Paraonidae		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
NON INDICATOR SPECIES																
CAMPH	Amphipods		3	5	17	7	4	8	1	2	0	9	19	4	**79**	**6.6**
CCRAB	Crabs		0	0	0	0	0	1	1	2	0	0	1	1	**6**	**0.5**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	0	0	0	2	0	0	0	0	**2**	**0.2**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	1	0	0	0	0	1	0	1	2	3	1	**9**	**0.8**
COTH	Other Crustaceans		1	0	0	0	1	0	0	0	0	1	0	0	**3**	**0.3**
BOTH	Bivalves		1	1	11	1	8	3	1	1	7	1	3	0	**38**	**3.2**
GOTH	Gastropods		0	0	0	0	0	0	1	0	3	1	2	1	**8**	**0.7**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	0	0	1	0	0	4	2	0	0	3	0	**11**	**0.9**
POTH	Polychaetes		0	1	1	0	0	0	1	2	2	1	4	1	**13**	**1.1**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	1	0	1	0	0	0	1	0	0	**3**	**0.3**
OTHER	Misc. Other		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
TOTAL			**30**	**31**	**62**	**40**	**46**	**43**	**47**	**70**	**45**	**43**	**68**	**92**	**617**	**51.4**

MI April 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	8	3	2	0	1	1	0	3	2	1	1	**22**	**1.8**
		>2	0	1	0	0	0	0	1	0	1	0	0	0	**3**	**0.3**
		Total	0	9	3	2	0	1	2	0	4	2	1	1	**25**	**2.1**
BAS	*Austrovenus stutchburyi*	<5	18	25	13	27	25	30	16	12	31	33	27	21	**278**	**23.2**
		>5	0	1	1	1	1	0	0	1	0	1	0	0	**6**	**0.5**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	18	26	14	28	26	30	16	13	31	34	27	21	**284**	**23.7**
BML	*Macamona liliana*	<5	4	5	0	1	5	4	1	1	3	5	2	0	**31**	**2.6**
		5-15	1	0	0	0	1	0	1	0	0	1	0	0	**4**	**0.3**
		>15	1	1	0	0	0	1	0	0	1	0	0	0	**4**	**0.3**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	6	6	0	1	6	5	2	1	4	6	2	0	**39**	**3.3**
BNH	*Nucula hartvigiana*	<2	1	0	1	1	0	1	1	0	3	1	1	1	**11**	**0.9**
		>2	1	0	0	2	0	1	1	0	0	0	0	0	**5**	**0.4**
		Total	2	0	1	3	0	2	2	0	3	1	1	1	**16**	**1.3**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	1	2	0	9	2	1	3	0	1	1	1	0	**21**	**1.8**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	2	0	9	2	1	3	0	1	1	1	0	**21**	**1.8**
CUMACEANS																
CCL	*Colurostylis lemurum*		5	2	0	4	2	2	11	1	2	2	1	3	**35**	**2.9**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	1	0	4	1	0	0	0	0	0	1	0	**7**	**0.6**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		2	20	49	14	3	0	7	27	12	12	16	10	**172**	**14.3**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	2	1	0	0	0	0	0	0	0	0	**3**	**0.3**
PHF	"Capitellidae"		1	4	3	4	1	2	0	4	4	3	2	1	**29**	**2.4**
PMD	*Magelona dakini*		5	1	1	0	1	0	0	0	0	0	1	0	**9**	**0.8**
PNIC	Nereidae		7	8	10	6	7	7	4	17	6	15	8	5	**100**	**8.3**
POP	*Orbinia papillosa*		4	3	0	0	2	5	3	0	9	0	4	8	**38**	**3.2**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	1	0	0	1	1	1	2	1	0	0	**7**	**0.6**
CCRAB	Crabs		0	0	0	0	0	0	0	0	1	1	1	0	**3**	**0.3**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		1	0	0	0	0	0	0	1	1	1	1	0	**5**	**0.4**
COST	Ostracods		0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
COTH	Other Crustaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BOTH	Bivalves		18	16	2	2	22	16	31	2	23	4	10	22	**168**	**14.0**
GOTH	Gastropods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	2	0	0	0	0	0	0	0	1	0	0	**4**	**0.3**
POTH	Polychaetes		2	2	14	8	2	2	2	3	2	6	2	3	**48**	**4.0**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	1	0	0	0	1	1	1	1	0	0	**5**	**0.4**
OTHER	Misc. Other		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
TOTAL			**73**	**103**	**101**	**86**	**75**	**75**	**85**	**72**	**106**	**91**	**79**	**75**	**1021**	**85.1**

KB July 2004

			CORE NUMBER													
INDICATOR SPECIES			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**TOTAL**	**MEAN**
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	1	1	4	2	2	2	2	0	1	2	5	1	**23**	**1.9**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	1	4	2	2	2	2	0	1	2	5	1	**23**	**1.9**
BAS	*Austrovenus stutchburyi*	<5	8	9	9	10	0	17	13	9	8	1	16	8	**108**	**9.0**
		>5	14	13	9	2	1	14	8	9	4	1	11	13	**99**	**8.3**
		Cond.analysis	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
		Total	22	22	18	12	2	31	21	18	12	2	27	21	**208**	**17.3**
BML	*Macamona liliana*	<5	0	1	5	3	2	4	1	1	3	3	2	2	**27**	**2.3**
		5-15	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	1	0	1	0	1	0	**3**	**0.3**
		Total	0	1	5	3	2	5	2	1	4	3	3	2	**31**	**2.6**
BNH	*Nucula hartvigiana*	<2	0	0	1	0	1	1	0	0	0	0	0	0	**3**	**0.3**
		>2	3	0	1	0	0	0	1	2	0	1	0	0	**8**	**0.7**
		Total	3	0	2	0	1	1	1	2	0	1	0	0	**11**	**0.9**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		1	1	2	3	1	1	0	0	0	0	0	0	**9**	**0.8**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	0	1	0	0	0	0	0	0	0	0	3	**4**	**0.3**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		3	6	33	10	6	7	0	0	6	0	2	1	**74**	**6.2**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		2	0	2	1	4	5	0	2	0	0	0	0	**16**	**1.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	1	1	2	2	0	0	0	1	1	**8**	**0.7**
PHF	"Capitellidae"		9	9	4	30	8	13	10	2	7	11	8	9	**120**	**10.0**
PMD	*Magelona dakini*		19	8	0	10	2	5	3	8	7	1	11	5	**79**	**6.6**
PNIC	Nereidae		2	0	1	2	3	1	1	0	1	2	0	0	**13**	**1.1**
POP	*Orbinia papillosa*		0	3	1	2	1	2	3	2	3	2	1	0	**20**	**1.7**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		1	2	0	0	1	1	2	0	0	4	2	2	**15**	**1.3**
CCRAB	Crabs		1	0	2	0	0	0	1	2	0	0	0	1	**7**	**0.6**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		2	1	0	0	0	2	2	0	1	0	2	1	**11**	**0.9**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	2	0	0	0	1	0	1	0	0	2	2	**8**	**0.7**
BOTH	Bivalves		0	5	0	0	5	5	0	2	3	4	3	2	**29**	**2.4**
GOTH	Gastropods		2	1	1	0	0	2	0	1	0	1	0	0	**8**	**0.7**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		5	0	1	2	1	1	3	1	4	0	2	0	**20**	**1.7**
POTH	Polychaetes		1	1	2	2	4	1	1	0	1	2	1	0	**16**	**1.3**
OOLIG	Oligochaetes		3	0	0	0	0	1	1	1	0	0	0	0	**6**	**0.5**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		2	1	0	2	0	0	2	0	1	1	0	0	**9**	**0.8**
TOTAL			**79**	**64**	**79**	**82**	**44**	**89**	**57**	**43**	**51**	**36**	**70**	**53**	**747**	**62.3**

KB October 2004

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	2	0	2	0	0	0	3	0	0	2	6	0	**15**	**1.3**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	2	0	2	0	0	0	3	0	0	2	6	0	**15**	**1.3**
BAS	*Austrovenus stutchburyi*	<5	4	1	4	2	4	6	2	2	1	4	5	10	**45**	**3.8**
		>5	8	3	4	6	17	9	14	4	0	4	3	5	**77**	**6.4**
		Cond.analysis	0	0	0	0	0	0	0	0	0	1	1	1	**3**	**0.3**
		Total	12	4	8	8	21	15	16	6	1	9	9	16	**125**	**10.4**
BML	*Macamona liliana*	<5	1	1	6	2	6	1	3	1	0	6	4	0	**31**	**2.6**
		5-15	0	1	1	0	0	0	0	0	1	0	1	0	**4**	**0.3**
		>15	0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	2	7	2	6	1	3	1	1	7	5	0	**36**	**3.0**
BNH	*Nucula hartvigiana*	<2	1	0	1	0	0	2	0	0	2	1	1	0	**8**	**0.7**
		>2	1	1	2	0	3	1	0	0	2	1	0	0	**11**	**0.9**
		Total	2	1	3	0	3	3	0	0	4	2	1	0	**19**	**1.6**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	1	0	0	0	1	0	1	0	0	0	0	**3**	**0.3**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		3	0	0	0	0	0	0	0	0	1	0	0	**4**	**0.3**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		3	12	1	0	0	1	2	0	1	1	0	0	**21**	**1.8**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		2	55	62	11	6	8	2	3	3	3	2	0	**157**	**13.1**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		3	2	0	2	3	1	3	0	0	0	0	1	**15**	**1.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.1**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	1	0	0	1	1	0	0	0	0	0	**3**	**0.3**
PGLY	*Glycera* sp.		2	5	2	3	4	4	2	3	0	1	0	1	**27**	**2.3**
PHF	"Capitellidae"		49	39	10	46	25	26	32	19	27	30	35	42	**380**	**31.7**
PMD	*Magelona dakini*		3	4	8	7	7	5	13	9	21	9	17	15	**118**	**9.8**
PNIC	Nereidae		2	0	3	0	0	1	2	1	1	0	1	0	**11**	**0.9**
POP	*Orbinia papillosa*		1	5	1	1	0	1	1	0	0	2	2	1	**15**	**1.3**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CCRAB	Crabs		1	0	0	1	2	1	0	0	1	1	1	0	**8**	**0.7**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	1	1	1	0	0	0	0	0	0	0	0	**3**	**0.3**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	0	1	3	1	0	0	1	0	0	0	**6**	**0.5**
BOTH	Bivalves		4	0	7	5	5	0	5	1	0	3	2	1	**33**	**2.8**
GOTH	Gastropods		0	1	0	0	1	4	2	1	0	0	1	1	**11**	**0.9**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		2	1	1	1	0	1	5	0	0	1	1	0	**13**	**1.1**
POTH	Polychaetes		1	1	3	0	0	0	1	1	3	0	1	1	**12**	**1.0**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		3	14	0	1	5	1	1	4	0	0	1	3	**33**	**2.8**
TOTAL			**96**	**148**	**120**	**90**	**91**	**76**	**95**	**50**	**64**	**72**	**85**	**82**	**1069**	**89.1**

KB January 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	28	6	3	5	1	4	23	2	0	0	3	0	**75**	**6.3**
		>2	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
		Total	29	6	3	5	1	4	23	2	0	0	3	0	**76**	**6.3**
BAS	*Austrovenus stutchburyi*	<5	4	1	4	8	2	4	5	2	1	2	3	2	**38**	**3.2**
		>5	3	1	1	0	1	2	3	11	3	4	6	3	**38**	**3.2**
		Cond.analysis	0	0	0	1	1	0	0	0	1	0	4	0	**7**	**0.6**
		Total	7	2	5	9	4	6	8	13	5	6	13	5	**83**	**6.9**
BML	*Macamona liliana*	<5	0	0	3	1	0	1	1	1	0	1	2	0	**10**	**0.8**
		5-15	0	0	0	3	0	0	0	0	0	1	2	0	**6**	**0.5**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
		Total	0	0	3	4	1	1	1	1	0	2	4	0	**17**	**1.4**
BNH	*Nucula hartvigiana*	<2	1	1	1	0	0	0	0	0	0	0	2	0	**5**	**0.4**
		>2	0	1	0	1	1	0	0	3	2	1	3	1	**13**	**1.1**
		Total	1	2	1	1	1	0	0	3	2	1	5	1	**18**	**1.5**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	3	1	0	1	0	0	1	0	0	3	**9**	**0.8**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		1	0	1	2	0	3	2	1	0	0	0	0	**10**	**0.8**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		4	1	6	1	4	1	5	0	4	1	3	1	**31**	**2.6**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
PAO	*Aonides oxycephala*		17	52	45	14	5	7	3	3	8	3	0	6	**163**	**13.6**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		1	0	3	0	0	0	0	0	0	0	0	0	**4**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		1	2	0	3	1	1	0	2	0	0	0	2	**12**	**1.0**
PHF	"Capitellidae"		15	13	27	26	9	26	17	16	34	24	20	15	**242**	**20.2**
PMD	*Magelona dakini*		10	1	10	4	11	8	7	6	19	9	13	6	**104**	**8.7**
PNIC	Nereidae		2	0	2	2	1	1	2	0	1	0	1	0	**12**	**1.0**
POP	*Orbinia papillosa*		7	0	2	0	0	1	0	4	1	1	0	0	**16**	**1.3**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	1	0	0	0	0	0	2	0	0	0	3	**6**	**0.5**
CCRAB	Crabs		2	1	1	1	0	0	1	0	2	0	1	1	**10**	**0.8**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		2	2	1	0	0	0	0	0	0	0	0	0	**5**	**0.4**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
COTH	Other Crustaceans		1	0	0	0	0	0	0	0	1	0	0	0	**2**	**0.2**
BOTH	Bivalves		7	2	3	3	0	1	3	1	0	7	4	1	**32**	**2.7**
GOTH	Gastropods		0	0	0	0	1	1	0	0	1	1	0	1	**5**	**0.4**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	0	2	0	0	1	0	1	1	2	0	1	**9**	**0.8**
POTH	Polychaetes		3	0	4	1	1	1	1	1	0	0	0	2	**14**	**1.2**
OOLIG	Oligochaetes		0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	1	0	0	0	1	0	0	0	**2**	**0.2**
OTHER	Misc. Other		1	1	0	0	0	0	0	0	0	0	1	0	**3**	**0.3**
TOTAL			**112**	**86**	**122**	**77**	**41**	**65**	**73**	**57**	**81**	**57**	**69**	**48**	**888**	**74.0**

KB April 2005

INDICATOR SPECIES			CORE NUMBER												TOTAL	MEAN
			1	2	3	4	5	6	7	8	9	10	11	12		
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	10	11	1	14	14	8	0	5	3	0	5	**71**	**5.9**
		>2	0	0	0	0	1	1	0	0	0	0	0	0	**2**	**0.2**
		Total	0	10	11	1	15	15	8	0	5	3	0	5	**73**	**6.1**
BAS	*Austrovenus stutchburyi*	<5	21	12	21	31	47	23	21	46	69	26	59	52	**428**	**35.7**
		>5	3	1	8	1	3	7	10	8	2	5	3	3	**54**	**4.5**
		Cond.analysis	2	0	0	0	0	5	4	0	0	3	0	1	**15**	**1.3**
		Total	26	13	29	32	50	35	35	54	71	34	62	56	**497**	**41.4**
BML	*Macamona liliana*	<5	0	0	0	2	0	0	0	2	0	1	3	0	**8**	**0.7**
		5-15	0	1	1	1	0	2	1	1	0	2	0	1	**10**	**0.8**
		>15	0	0	0	1	0	0	0	1	0	0	0	0	**2**	**0.2**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	1	1	4	0	2	1	4	0	3	3	1	**20**	**1.7**
BNH	*Nucula hartvigiana*	<2	1	0	0	0	2	1	0	1	0	0	0	0	**5**	**0.4**
		>2	1	0	1	0	0	0	1	0	0	0	0	2	**5**	**0.4**
		Total	2	0	1	0	2	1	1	1	0	0	0	2	**10**	**0.8**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		1	0	0	1	1	1	1	1	0	2	7	1	**16**	**1.3**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		1	1	2	0	5	3	7	2	1	0	0	1	**23**	**1.9**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		5	75	3	57	1	4	6	4	1	1	2	2	**161**	**13.4**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		2	0	0	0	0	1	0	1	0	0	0	0	**4**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	1	0	0	0	0	0	1	0	1	0	**3**	**0.3**
PHF	"Capitellidae"		16	1	12	4	12	17	19	4	4	4	27	9	**129**	**10.8**
PMD	*Magelona dakini*		5	5	4	3	1	10	7	2	6	5	12	15	**75**	**6.3**
PNIC	Nereidae		1	1	2	6	1	1	0	1	0	1	0	0	**14**	**1.2**
POP	*Orbinia papillosa*		0	0	0	2	0	2	0	0	0	0	0	0	**4**	**0.3**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	0	1	0	1	0	0	0	0	0	**2**	**0.2**
CCRAB	Crabs		0	1	0	1	0	1	2	0	1	1	0	0	**7**	**0.6**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		1	0	1	0	1	1	0	1	0	2	0	0	**7**	**0.6**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	1	0	0	0	2	0	0	0	1	0	**4**	**0.3**
BOTH	Bivalves		0	0	0	4	0	0	2	2	1	1	5	1	**16**	**1.3**
GOTH	Gastropods		0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	1	0	0	0	0	0	0	0	0	0	0	**2**	**0.2**
POTH	Polychaetes		0	0	1	0	0	0	0	0	1	0	0	2	**4**	**0.3**
OOLIG	Oligochaetes		0	1	0	0	0	1	0	0	0	0	0	0	**2**	**0.2**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		1	4	1	4	5	2	8	0	0	9	7	4	**45**	**3.8**
TOTAL			**62**	**114**	**70**	**119**	**95**	**97**	**100**	**77**	**92**	**67**	**128**	**99**	**1120**	**93.3**

Appendix 2 - Whaingaroa Harbour species/taxonomic group abundances

TU October 2004

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	1	1	0	2	0	0	0	1	1	0	0	**6**	**0.5**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	1	2	5	3	41	17	5	4	1	6	3	15	**103**	**8.6**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	2	5	3	41	17	5	4	1	6	3	15	**103**	**8.6**
BAS	*Austrovenus stutchburyi*	<5	26	42	37	22	50	40	46	29	16	14	32	43	**397**	**33.1**
		>5	27	23	14	37	16	81	35	23	22	29	35	41	**383**	**31.9**
		Cond.analysis	0	0	0	0	0	1	4	3	1	0	0	0	**9**	**0.8**
		Total	53	65	51	59	66	122	85	55	39	43	67	84	**789**	**65.8**
BML	*Macamona liliana*	<5	2	0	1	2	10	3	4	3	4	1	12	1	**43**	**3.6**
		5-15	1	0	0	1	4	1	1	2	3	1	3	4	**21**	**1.8**
		>15	3	4	5	2	1	2	2	2	5	2	3	0	**31**	**2.6**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	6	4	6	5	15	6	7	7	12	4	18	5	**95**	**7.9**
BNH	*Nucula hartvigiana*	<2	4	2	5	6	6	6	4	4	6	5	5	10	**63**	**5.3**
		>2	25	20	34	18	15	34	29	29	24	51	42	36	**357**	**29.8**
		Total	29	22	39	24	21	40	33	33	30	56	47	46	**420**	**35.0**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	3	0	0	1	0	0	1	3	1	1	0	**10**	**0.8**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		1	8	18	10	7	21	6	3	18	21	8	6	**127**	**10.6**
OTHER																
OAN	*Anthopleura aureoradiata*		3	15	3	7	1	2	2	0	2	1	1	2	**39**	**3.3**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		20	0	14	0	3	14	6	2	5	3	2	5	**74**	**6.2**
PAGL	*Aglaophamus* sp.		0	0	0	2	0	0	0	0	1	0	1	0	**4**	**0.3**
PAO	*Aonides oxycephala*		0	0	0	2	0	4	0	2	1	25	8	0	**42**	**3.5**
PAR	*Aricidea* sp.		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PBOC	Pseudopolydora complex		0	1	0	0	0	0	0	1	0	1	0	0	**3**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		4	2	0	1	1	2	2	1	2	0	0	3	**18**	**1.5**
PHF	"Capitellidae"		12	10	10	5	11	5	5	4	5	2	2	16	**87**	**7.3**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		0	1	1	3	5	4	4	3	1	3	0	1	**26**	**2.2**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	1	0	1	0	0	0	0	0	0	0	**2**	**0.2**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	2	2	0	0	2	0	2	0	0	0	0	**8**	**0.7**
CCRAB	Crabs		0	0	0	0	1	0	2	2	0	1	0	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	1	1	0	2	0	0	0	4	1	0	**9**	**0.8**
BOTH	Bivalves		0	0	2	2	4	4	1	1	3	2	2	1	**22**	**1.8**
GOTH	Gastropods		1	2	24	13	7	13	9	11	14	20	7	9	**130**	**10.8**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	5	0	0	1	1	0	1	2	2	0	0	**13**	**1.1**
POTH	Polychaetes		21	19	4	1	2	9	11	1	2	0	4	12	**86**	**7.2**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
OEDW	*Edwardsia*		0	1	1	0	0	0	0	2	0	0	0	0	**4**	**0.3**
OTHER	Misc. Other		4	5	4	1	4	0	1	0	2	1	2	0	**24**	**2.0**
TOTAL			**158**	**168**	**187**	**139**	**195**	**268**	**179**	**136**	**144**	**197**	**174**	**205**	**2144**	**178.7**

TU April 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	5	41	0	7	4	10	4	1	4	3	15	**94**	**7.8**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	5	41	0	7	4	10	4	1	4	3	15	**94**	**7.8**
BAS	*Austrovenus stutchburyi*	<5	7	22	13	9	9	18	28	11	30	26	20	11	**204**	**17.0**
		>5	35	37	22	40	47	36	25	22	34	34	36	18	**386**	**32.2**
		Cond.analysis	1	1	1	0	0	4	6	3	7	0	1	5	**29**	**2.4**
		Total	43	60	36	49	56	58	59	36	71	60	57	34	**619**	**51.6**
BML	*Macamona liliana*	<5	1	3	0	1	1	0	2	0	0	1	1	0	**10**	**0.8**
		5-15	0	1	2	0	1	1	1	0	0	1	1	0	**8**	**0.7**
		>15	1	1	4	3	1	3	3	0	3	3	2	2	**26**	**2.2**
		Cond.analysis	2	1	0	0	0	4	1	2	1	2	2	1	**16**	**1.3**
		Total	4	6	6	4	3	8	7	2	4	7	6	3	**60**	**5.0**
BNH	*Nucula hartvigiana*	<2	5	8	2	4	3	4	8	3	9	7	7	10	**70**	**5.8**
		>2	52	39	37	22	41	22	34	41	34	44	30	16	**412**	**34.3**
		Total	57	47	39	26	44	26	42	44	43	51	37	26	**482**	**40.2**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	1	0	0	0	0	0	1	0	3	0	0	**5**	**0.4**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		13	18	18	23	28	7	8	12	9	34	8	24	**202**	**16.8**
OTHER																
OAN	*Anthopleura aureoradiata*		2	4	3	4	7	5	5	3	3	1	2	5	**44**	**3.7**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		12	16	14	6	8	9	6	24	9	11	17	14	**146**	**12.2**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		11	0	7	22	14	2	0	1	0	2	0	0	**59**	**4.9**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PBOC	Pseudopolydora complex		0	0	1	0	0	0	0	1	0	0	0	0	**2**	**0.2**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	3	5	3	1	0	2	0	1	0	1	4	**20**	**1.7**
PHF	"Capitellidae"		2	7	0	1	1	8	3	14	2	3	10	17	**68**	**5.7**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		0	4	2	1	4	5	1	4	2	0	2	3	**28**	**2.3**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	1	0	0	0	1	0	1	1	1	**5**	**0.4**
CCRAB	Crabs		1	1	1	1	1	1	1	2	2	1	1	2	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	5	0	1	0	5	0	1	1	0	0	**13**	**1.1**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	1	1	2	0	0	0	0	0	0	2	**6**	**0.5**
BOTH	Bivalves		0	1	1	2	0	1	2	0	0	1	0	0	**8**	**0.7**
GOTH	Gastropods		8	3	12	11	15	7	9	10	2	14	9	4	**104**	**8.7**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
ONEM	Nemerteans		1	3	0	0	0	0	0	1	0	0	0	3	**8**	**0.7**
POTH	Polychaetes		2	6	6	3	0	4	1	1	3	0	1	2	**29**	**2.4**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		0	1	1	2	1	0	0	1	0	1	1	1	**9**	**0.8**
TOTAL			**157**	**186**	**199**	**160**	**193**	**145**	**161**	**163**	**153**	**196**	**156**	**160**	**2014**	**167.8**

HB October 2004

INDICATOR SPECIES		SIZE	CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		12	1	2	1	3	1	4	2	5	2	6	6	**45**	**3.8**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	1	9	6	6	6	4	13	13	4	6	2	2	**72**	**6.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	1	9	6	6	6	4	13	13	4	6	2	2	**72**	**6.0**
BAS	*Austrovenus stutchburyi*	<5	0	3	3	4	8	13	10	4	5	10	1	10	**71**	**5.9**
		>5	0	2	0	2	1	0	2	2	0	0	1	2	**12**	**1.0**
		Cond.analysis	0	0	1	1	1	0	0	0	0	0	0	0	**3**	**0.3**
		Total	0	5	4	7	10	13	12	6	5	10	2	12	**86**	**7.2**
BML	*Macamona liliana*	<5	0	0	1	0	0	0	1	2	1	1	0	1	**7**	**0.6**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	1	0	0	0	1	2	1	1	0	1	**7**	**0.6**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
		Total	0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	1	1	0	1	0	1	3	2	1	0	0	**10**	**0.8**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	1	1	0	0	0	0	**2**	**0.2**
PAO	*Aonides oxycephala*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
PBOC	Pseudopolydora complex		0	0	0	0	0	0	0	0	0	0	1	1	**2**	**0.2**
PCOS	*Cossura* sp.		0	0	0	0	1	1	0	0	0	0	0	0	**2**	**0.2**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	1	0	0	0	2	0	1	1	0	**5**	**0.4**
PHF	"Capitellidae"		9	10	6	9	8	9	7	10	21	15	13	9	**126**	**10.5**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		7	6	8	3	4	7	6	4	9	4	8	4	**70**	**5.8**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		5	4	11	3	4	3	4	1	2	5	1	1	**44**	**3.7**
CCRAB	Crabs		0	0	4	0	0	0	1	1	0	3	1	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	0	0	0	0	0	1	0	1	**2**	**0.2**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		1	0	1	0	10	6	0	1	1	1	2	0	**23**	**1.9**
COTH	Other Crustaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BOTH	Bivalves (*P. disculus*)		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
GOTH	Gastropods		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		3	0	0	0	1	0	1	0	1	0	0	0	**6**	**0.5**
POTH	Polychaetes		1	2	1	2	3	1	1	0	0	1	2	1	**15**	**1.3**
OOLIG	Oligochaetes		0	0	0	0	0	0	2	0	0	0	0	0	**2**	**0.2**
OFLAT	Flatworms		0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		0	0	0	0	2	0	0	0	0	0	0	0	**2**	**0.2**
TOTAL			**39**	**42**	**45**	**33**	**53**	**46**	**54**	**46**	**51**	**51**	**39**	**39**	**528**	**44.0**

HB April 2005

INDICATOR SPECIES		SIZE	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
			CORE NUMBER													
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		3	0	1	3	0	0	0	1	0	1	2	0	**11**	**0.9**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	31	3	2	8	1	0	4	0	1	1	2	8	**61**	**5.1**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	31	3	2	8	1	0	4	0	1	1	2	8	**61**	**5.1**
BAS	*Austrovenus stutchburyi*	<5	4	0	0	1	4	4	4	2	5	1	1	5	**31**	**2.6**
		>5	1	0	0	2	1	0	1	1	1	0	0	1	**8**	**0.7**
		Cond.analysis	0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.1**
		Total	5	0	0	3	5	4	6	3	6	1	1	6	**40**	**3.3**
BML	*Macamona liliana*	<5	12	4	7	6	3	5	7	8	14	5	1	3	**75**	**6.3**
		5-15	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	12	4	7	6	3	5	7	8	15	5	1	3	**76**	**6.3**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	1	0	0	0	1	1	0	0	0	0	**3**	**0.3**
		Total	0	0	1	0	0	0	1	1	0	0	0	0	**3**	**0.3**
CUMACEANS																
CCL	*Colurostylis lemurum*		3	1	5	0	0	0	0	0	0	2	0	1	**12**	**1.0**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		5	1	3	1	4	2	0	6	2	1	3	1	**29**	**2.4**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAR	*Aricidea* sp.		1	0	0	0	0	0	0	1	0	0	0	0	**2**	**0.2**
PBOC	Pseudopolydora complex		1	0	1	0	0	0	1	0	0	0	0	0	**3**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	1	0	0	0	0	1	0	0	0	0	0	**2**	**0.2**
PHF	"Capitellidae"		14	3	5	8	9	12	6	11	9	7	9	10	**103**	**8.6**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		3	1	4	2	2	2	3	6	4	9	0	1	**37**	**3.1**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	19	4	0	1	2	0	1	1	0	3	**31**	**2.6**
CCRAB	Crabs		7	5	5	1	3	2	2	1	2	2	4	1	**0**	**0.0**
CCUM	Cumaceans		2	1	5	0	0	1	2	0	0	2	2	0	**15**	**1.3**
CISO	Isopods		2	0	4	0	0	0	0	0	0	1	0	0	**7**	**0.6**
COST	Ostracods		1	0	2	1	0	0	0	0	0	0	0	0	**4**	**0.3**
CSHR	Shrimps/Mysids		0	0	1	1	3	0	1	2	0	0	1	1	**10**	**0.8**
COTH	Other Crustaceans		0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
BOTH	Bivalves		1	1	0	0	0	0	1	0	0	0	1	0	**4**	**0.3**
GOTH	Gastropods		1	0	0	1	0	2	1	0	1	0	0	1	**7**	**0.6**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		2	0	0	2	0	1	0	0	0	0	0	0	**5**	**0.4**
POTH	Polychaetes		1	1	1	0	0	0	1	1	1	1	0	0	**7**	**0.6**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
TOTAL			**95**	**22**	**66**	**41**	**30**	**32**	**39**	**41**	**42**	**35**	**26**	**36**	**470**	**39.2**

X October 2004

INDICATOR SPECIES		SIZE	CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		4	3	2	0	1	0	1	0	2	0	1	0	**14**	**1.2**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	5	0	0	9	5	1	1	5	1	0	**27**	**2.3**
		>2	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
		Total	0	0	5	0	0	10	5	1	1	5	1	0	**28**	**2.3**
BAS	*Austrovenus stutchburyi*	<5	18	87	29	69	65	28	40	88	32	36	37	45	**574**	**47.8**
		>5	7	5	9	9	17	10	8	7	10	3	5	14	**104**	**8.7**
		Cond.analysis	0	13	1	3	4	3	2	3	2	5	0	6	**42**	**3.5**
		Total	25	105	39	81	86	41	50	98	44	44	42	65	**720**	**60.0**
BML	*Macamona liliana*	<5	0	16	16	11	4	10	8	12	8	11	6	22	**124**	**10.3**
		5-15	0	2	0	0	3	2	2	1	0	2	2	1	**15**	**1.3**
		>15	1	1	3	2	1	0	0	4	2	0	1	1	**16**	**1.3**
		Cond.analysis	0	0	0	1	0	0	1	0	0	0	0	1	**3**	**0.3**
		Total	1	19	19	14	8	12	11	17	10	13	9	25	**158**	**13.2**
BNH	*Nucula hartvigiana*	<2	11	13	6	1	2	2	8	8	3	0	4	14	**72**	**6.0**
		>2	17	26	14	6	33	3	14	54	20	1	0	29	**217**	**18.1**
		Total	28	39	20	7	35	5	22	62	23	1	4	43	**289**	**24.1**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
		Total	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	3	7	0	0	1	0	2	2	0	0	4	**19**	**1.6**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		3	2	5	1	4	25	5	3	2	0	6	23	**79**	**6.6**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		30	4	21	10	6	15	6	4	2	13	6	7	**124**	**10.3**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
PAO	*Aonides oxycephala*		0	0	1	0	2	0	1	0	0	0	1	0	**5**	**0.4**
PAR	*Aricidea* sp.		0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
PBOC	Pseudopolydora complex		1	1	0	0	0	0	0	0	0	0	1	0	**3**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PGLY	*Glycera* sp.		4	3	2	0	4	3	0	1	3	2	3	2	**27**	**2.3**
PHF	"Capitellidae"		22	12	7	10	6	6	6	12	5	11	17	9	**123**	**10.3**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		0	0	0	1	1	3	1	0	1	3	3	3	**16**	**1.3**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	0	0	2	51	15	0	**68**	**5.7**
NON INDICATOR SPECIES																
CAMPH	Amphipods		10	7	2	3	1	1	3	1	1	0	0	15	**44**	**3.7**
CCRAB	Crabs		1	2	0	1	0	0	0	0	0	0	1	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	1	1	0	0	0	0	0	0	0	0	0	**2**	**0.2**
COST	Ostracods		1	1	2	0	1	1	2	2	1	0	0	2	**13**	**1.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		1	7	16	14	12	2	4	1	5	2	3	8	**75**	**6.3**
BOTH	Bivalves		0	2	0	1	2	0	4	2	1	0	0	2	**14**	**1.2**
GOTH	Gastropods		2	4	9	6	14	12	2	4	1	1	3	19	**77**	**6.4**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		1	0	0	0	1	0	0	0	0	0	0	0	**2**	**0.2**
ONEM	Nemerteans		2	1	2	0	1	1	0	2	1	2	14	0	**26**	**2.2**
POTH	Polychaetes		10	11	5	5	0	1	1	8	1	2	2	4	**50**	**4.2**
OOLIG	Oligochaetes		0	0	2	2	0	0	0	1	0	0	0	0	**5**	**0.4**
OFLAT	Flatworms		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
OEDW	*Edwardsia*		0	0	0	0	1	0	1	0	0	0	0	1	**3**	**0.3**
OTHER	Misc. Other		7	53	62	16	5	15	66	19	8	27	0	11	**289**	**24.1**
TOTAL			**153**	**281**	**229**	**172**	**193**	**154**	**191**	**242**	**117**	**177**	**133**	**243**	**2280**	**190.0**

X April 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	2	1	3	0	2	3	0	0	3	1	0	**15**	**1.3**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	2	2	0	0	0	1	2	1	0	1	**9**	**0.8**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	2	2	0	0	0	1	2	1	0	1	**9**	**0.8**
BAS	*Austrovenus stutchburyi*	<5	0	5	1	2	3	3	6	10	8	8	10	8	**64**	**5.3**
		>5	10	15	8	4	18	10	21	12	16	13	18	13	**158**	**13.2**
		Cond.analysis	0	2	4	0	6	14	0	3	0	0	1	0	**30**	**2.5**
		Total	10	22	13	6	27	27	27	25	24	21	29	21	**252**	**21.0**
BML	*Macamona liliana*	<5	10	5	3	1	6	5	8	0	4	4	3	5	**54**	**4.5**
		5-15	2	0	0	2	2	2	1	1	0	0	1	0	**11**	**0.9**
		>15	1	2	2	0	1	2	1	2	0	1	1	1	**14**	**1.2**
		Cond.analysis	2	1	1	0	2	2	4	3	2	3	1	0	**21**	**1.8**
		Total	15	8	6	3	11	11	14	6	6	8	6	6	**100**	**8.3**
BNH	*Nucula hartvigiana*	<2	7	8	2	0	4	6	6	4	1	5	5	8	**56**	**4.7**
		>2	13	12	3	0	23	22	18	15	1	16	21	39	**183**	**15.3**
		Total	20	20	5	0	27	28	24	19	2	21	26	47	**239**	**19.9**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		4	4	3	0	3	5	3	1	0	0	3	3	**29**	**2.4**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		2	2	0	0	4	1	1	3	0	3	9	1	**26**	**2.2**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		2	14	11	2	10	21	13	7	11	8	11	3	**113**	**9.4**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.1**
PAR	*Aricidea* sp.		0	0	0	0	0	1	0	0	0	0	0	2	**3**	**0.3**
PBOC	Pseudopolydora complex		1	0	0	0	0	1	0	1	2	0	0	0	**5**	**0.4**
PCOS	*Cossura* sp.		0	0	0	3	0	0	0	0	0	0	0	0	**3**	**0.3**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		2	0	0	1	1	0	1	0	1	3	2	0	**11**	**0.9**
PHF	"Capitellidae"		12	11	6	11	10	15	11	7	4	13	13	15	**128**	**10.7**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		1	2	7	3	1	1	0	2	0	1	0	0	**18**	**1.5**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	2	4	0	0	0	0	0	0	1	0	**7**	**0.6**
NON INDICATOR SPECIES																
CAMPH	Amphipods		1	2	4	0	1	0	5	2	1	1	1	0	**18**	**1.5**
CCRAB	Crabs		2	1	1	2	0	0	1	0	2	1	0	1	**11**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	3	0	0	0	0	1	0	1	**5**	**0.4**
COST	Ostracods		0	1	2	1	0	0	0	1	0	1	1	0	**7**	**0.6**
CSHR	Shrimps/Mysids		0	1	1	0	0	0	0	0	0	0	1	0	**3**	**0.3**
COTH	Other Crustaceans		4	4	4	2	3	0	10	0	1	1	1	8	**38**	**3.2**
BOTH	Bivalves		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
GOTH	Gastropods		3	2	1	2	7	3	0	3	0	0	3	4	**28**	**2.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		2	0	1	1	0	0	2	0	0	1	1	0	**8**	**0.7**
POTH	Polychaetes		0	1	15	0	2	0	1	6	9	0	0	2	**36**	**3.0**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
OFLAT	Flatworms		0	0	0	0	2	0	0	0	0	0	0	0	**2**	**0.2**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		2	1	0	2	0	0	0	1	0	0	3	2	**11**	**0.9**
TOTAL			**83**	**99**	**85**	**48**	**113**	**117**	**116**	**85**	**66**	**88**	**112**	**117**	**1129**	**93.2**

WI July 2004

INDICATOR SPECIES		SIZE	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
			CORE NUMBER													
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	8	2	3	3	5	5	3	8	5	26	8	3	**79**	**6.6**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	8	2	3	3	5	5	3	8	5	26	8	3	**79**	**6.6**
BAS	*Austrovenus stutchburyi*	<5	6	16	13	15	24	35	23	20	25	18	13	19	**227**	**18.9**
		>5	23	16	9	12	31	19	14	14	17	18	26	13	**212**	**17.7**
		Cond.analysis	0	0	0	0	0	7	1	8	0	3	0	0	**19**	**1.6**
		Total	29	32	22	27	55	61	38	42	42	39	39	32	**458**	**38.2**
BML	*Macamona liliana*	<5	3	2	7	2	4	3	7	3	11	6	2	7	**57**	**4.8**
		5-15	0	1	4	0	1	1	1	1	1	1	0	0	**11**	**0.9**
		>15	1	0	1	3	8	5	5	2	3	1	2	1	**32**	**2.7**
		Cond.analysis	2	2	1	2	0	3	4	4	2	1	2	2	**25**	**2.1**
		Total	6	5	13	7	13	12	17	10	17	9	6	10	**125**	**10.4**
BNH	*Nucula hartvigiana*	<2	6	8	2	2	4	8	2	0	3	13	0	2	**50**	**4.2**
		>2	14	21	6	11	18	41	4	15	18	48	18	15	**229**	**19.1**
		Total	20	29	8	13	22	49	6	15	21	61	18	17	**279**	**23.3**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	0	0	0	2	0	0	0	0	0	**2**	**0.2**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		12	4	7	11	21	14	14	9	12	14	11	8	**137**	**11.4**
OTHER																
OAN	*Anthopleura aureoradiata*		1	1	1	0	1	1	0	0	0	0	3	0	**8**	**0.7**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		5	2	18	10	22	10	9	15	11	13	2	2	**119**	**9.9**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		2	1	0	0	0	0	0	0	0	0	1	0	**4**	**0.3**
PAR	*Aricidea* sp.		0	0	2	2	1	1	0	0	1	1	0	1	**9**	**0.8**
PBOC	Pseudopolydora complex		0	0	0	0	1	1	0	1	0	0	0	0	**3**	**0.3**
PCOS	*Cossura* sp.		0	0	0	0	1	1	0	0	0	0	0	0	**2**	**0.2**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		0	0	0	0	2	0	1	0	0	3	0	0	**6**	**0.5**
PHF	"Capitellidae"		20	18	38	24	44	22	16	24	18	19	15	6	**264**	**22.0**
PMD	*Magelona dakini*		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PNIC	Nereidae		1	0	1	2	3	2	0	2	0	5	1	1	**18**	**1.5**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	2	0	3	0	1	0	0	0	0	0	**6**	**0.5**
NON INDICATOR SPECIES																
CAMPH	Amphipods		2	0	0	0	0	0	1	1	6	0	0	1	**11**	**0.9**
CCRAB	Crabs		1	0	1	1	3	4	0	1	1	1	0	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	1	0	1	0	1	2	0	3	1	0	0	**9**	**0.8**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	6	0	0	0	0	0	0	0	0	**6**	**0.5**
COTH	Other Crustaceans		1	1	4	1	11	1	0	2	7	3	2	3	**36**	**3.0**
BOTH	Bivalves		0	0	2	0	0	0	1	0	1	3	0	0	**7**	**0.6**
GOTH	Gastropods		10	18	10	19	15	21	10	11	13	14	9	9	**159**	**13.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	1	3	0	0	1	1	0	2	0	0	0	**8**	**0.7**
POTH	Polychaetes		3	7	9	12	21	21	8	20	1	23	5	10	**140**	**11.7**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		0	4	3	2	2	3	3	0	1	2	1	1	**22**	**1.8**
TOTAL			**122**	**126**	**147**	**141**	**246**	**231**	**133**	**161**	**162**	**237**	**121**	**104**	**1918**	**159.8**

WI October 2004

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.1**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	4	12	15	10	2	13	13	10	11	9	1	7	**107**	**8.9**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	4	12	15	10	2	13	13	10	11	9	1	7	**107**	**8.9**
BAS	*Austrovenus stutchburyi*	<5	18	41	31	30	10	39	85	38	101	88	84	70	**635**	**52.9**
		>5	14	7	15	25	7	8	14	33	9	8	4	2	**146**	**12.2**
		Cond.analysis	0	0	0	4	6	1	0	0	13	3	1	0	**28**	**2.3**
		Total	32	48	46	59	23	48	99	71	123	99	89	72	**809**	**67.4**
BML	*Macamona liliana*	<5	1	7	8	10	4	18	4	3	5	8	18	7	**93**	**7.8**
		5-15	1	0	2	3	0	1	0	7	1	2	3	4	**24**	**2.0**
		>15	4	3	5	4	5	1	7	1	2	3	5	1	**41**	**3.4**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	6	10	15	17	9	20	11	11	8	13	26	12	**158**	**13.2**
BNH	*Nucula hartvigiana*	<2	9	11	14	9	0	28	24	16	14	13	32	25	**195**	**16.3**
		>2	13	7	9	12	1	9	20	9	7	32	13	18	**150**	**12.5**
		Total	22	18	23	21	1	37	44	25	21	45	45	43	**345**	**28.8**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	0	0	0	0	0	0	1	1	0	**2**	**0.2**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		18	14	15	13	11	18	31	6	29	7	14	14	**190**	**15.8**
OTHER																
OAN	*Anthopleura aureoradiata*		0	4	5	2	0	0	1	3	0	3	0	4	**22**	**1.8**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		22	33	5	15	0	12	15	15	22	2	9	37	**187**	**15.6**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	0	0	0	0	0	0	0	0	2	2	0	**4**	**0.3**
PAR	*Aricidea* sp.		6	4	2	10	5	0	2	3	9	5	0	10	**56**	**4.7**
PBOC	Pseudopolydora complex		0	1	0	0	0	0	0	0	0	0	2	0	**3**	**0.3**
PCOS	*Cossura* sp.		1	0	0	1	0	0	0	1	0	0	0	0	**3**	**0.3**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		3	1	1	3	3	4	2	2	2	2	1	5	**29**	**2.4**
PHF	"Capitellidae"		44	40	17	46	36	50	27	33	77	23	22	52	**467**	**38.9**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		4	1	3	2	0	2	1	3	6	2	2	0	**26**	**2.2**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		3	11	0	4	6	9	4	1	6	8	5	18	**75**	**6.3**
NON INDICATOR SPECIES																
CAMPH	Amphipods		10	2	0	2	0	4	6	3	3	0	1	2	**33**	**2.8**
CCRAB	Crabs		0	2	0	0	2	1	3	4	2	0	1	3	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		1	1	0	0	0	2	0	0	1	1	7	0	**13**	**1.1**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		4	2	0	4	6	0	0	0	8	0	0	2	**26**	**2.2**
BOTH	Bivalves		0	0	2	0	1	1	0	0	1	0	1	3	**9**	**0.8**
GOTH	Gastropods		7	8	19	7	15	10	20	3	35	9	32	20	**185**	**15.4**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		5	14	0	0	1	1	1	2	1	1	1	1	**28**	**2.3**
POTH	Polychaetes		31	17	3	10	1	1	4	7	24	9	5	16	**128**	**10.7**
OOLIG	Oligochaetes		0	0	2	0	1	0	0	0	1	2	0	0	**6**	**0.5**
OFLAT	Flatworms		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		9	6	3	3	6	3	11	6	56	23	16	62	**204**	**17.0**
TOTAL			**232**	**250**	**177**	**229**	**129**	**236**	**295**	**209**	**446**	**266**	**284**	**383**	**3118**	**259.8**

WI January 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	1	0	1	1	0	0	0	0	1	0	0	**4**	**0.3**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	18	5	11	3	7	9	26	9	20	3	2	1	**114**	**9.5**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	18	5	11	3	7	9	26	9	20	3	2	1	**114**	**9.5**
BAS	*Austrovenus stutchburyi*	<5	19	31	25	21	28	38	16	35	22	26	14	9	**284**	**23.7**
		>5	31	18	14	6	8	4	28	24	22	17	3	5	**180**	**15.0**
		Cond.analysis	0	7	8	1	6	3	0	0	0	12	0	0	**37**	**3.1**
		Total	50	56	47	28	42	45	44	59	44	55	17	14	**501**	**41.8**
BML	*Macamona liliana*	<5	0	2	2	3	1	3	1	2	2	0	3	6	**25**	**2.1**
		5-15	2	2	1	2	0	1	1	0	1	7	1	0	**18**	**1.5**
		>15	3	2	5	4	5	2	1	5	2	2	4	2	**37**	**3.1**
		Cond.analysis	1	2	0	2	0	3	3	1	1	0	3	3	**19**	**1.6**
		Total	6	8	8	11	6	9	6	8	6	9	11	11	**99**	**8.3**
BNH	*Nucula hartvigiana*	<2	45	54	55	55	22	19	36	40	33	13	34	12	**418**	**34.8**
		>2	11	18	19	4	19	10	9	16	20	22	14	29	**191**	**15.9**
		Total	56	72	74	59	41	29	45	56	53	35	48	41	**609**	**50.8**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		13	7	14	18	12	47	16	24	8	41	19	12	**231**	**19.3**
OTHER																
OAN	*Anthopleura aureoradiata*		1	1	0	3	1	0	2	1	1	5	0	0	**15**	**1.3**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		14	13	9	14	16	20	21	25	18	43	13	23	**229**	**19.1**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	0	0	0	0	3	0	0	0	0	1	0	**4**	**0.3**
PAR	*Aricidea* sp.		4	9	3	6	2	0	2	6	5	7	8	4	**56**	**4.7**
PBOC	Pseudopolydora complex		1	1	1	1	0	0	0	2	1	1	2	1	**11**	**0.9**
PCOS	*Cossura* sp.		0	2	1	1	0	4	0	0	0	0	0	0	**8**	**0.7**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGLY	*Glycera* sp.		3	2	4	1	1	2	0	2	2	2	2	0	**21**	**1.8**
PHF	"Capitellidae"		42	36	15	26	30	28	37	29	47	59	28	26	**403**	**33.6**
PMD	*Magelona dakini*		0	0	0	0	0	0	1	0	1	0	1	0	**3**	**0.3**
PNIC	Nereidae		1	4	3	0	2	3	2	1	1	3	2	0	**22**	**1.8**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		1	0	1	4	3	4	0	2	0	1	0	1	**17**	**1.4**
NON INDICATOR SPECIES																
CAMPH	Amphipods		1	2	0	0	2	1	0	3	0	0	0	2	**11**	**0.9**
CCRAB	Crabs		1	1	1	1	2	3	3	0	2	3	2	1	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		2	1	0	1	0	2	1	2	0	1	0	2	**12**	**1.0**
COST	Ostracods		0	1	1	0	0	0	1	0	0	0	0	0	**3**	**0.3**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	1	1	0	0	0	3	2	1	7	0	1	**16**	**1.3**
BOTH	Bivalves		3	1	2	4	1	3	2	2	0	0	1	0	**19**	**1.6**
GOTH	Gastropods		8	7	5	17	5	16	8	26	13	16	5	6	**132**	**11.0**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	1	0	3	3	2	0	0	0	0	1	1	**11**	**0.9**
POTH	Polychaetes		9	9	9	7	10	8	10	10	8	25	21	2	**128**	**10.7**
OOLIG	Oligochaetes		0	0	0	0	2	0	0	0	0	0	0	0	**2**	**0.2**
OFLAT	Flatworms		0	0	1	4	0	0	0	0	0	0	0	0	**5**	**0.4**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		3	0	0	0	2	0	1	0	1	4	1	2	**14**	**1.2**
TOTAL			**237**	**241**	**211**	**213**	**191**	**238**	**231**	**269**	**232**	**321**	**185**	**151**	**2700**	**225.0**

WI April 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	5	2	15	5	2	0	1	5	5	13	13	4	**70**	**5.8**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	5	2	15	5	2	0	1	5	5	13	13	4	**70**	**5.8**
BAS	*Austrovenus stutchburyi*	<5	13	3	1	10	10	3	8	4	5	13	4	5	**79**	**6.6**
		>5	8	6	15	15	5	19	7	21	17	17	7	20	**157**	**13.1**
		Cond.analysis	7	0	2	5	0	0	1	0	5	6	6	0	**32**	**2.7**
		Total	28	9	18	30	15	22	16	25	27	36	17	25	**268**	**22.3**
BML	*Macamona liliana*	<5	3	3	1	11	4	5	6	5	3	3	4	4	**52**	**4.3**
		5-15	3	1	1	2	3	1	3	1	0	0	1	4	**20**	**1.7**
		>15	4	2	3	2	3	0	2	2	5	0	3	3	**29**	**2.4**
		Cond.analysis	0	2	3	2	3	5	1	1	0	2	2	1	**22**	**1.8**
		Total	10	8	8	17	13	11	12	9	8	5	10	12	**123**	**10.3**
BNH	*Nucula hartvigiana*	<2	14	10	8	9	6	11	10	9	9	12	17	5	**120**	**10.0**
		>2	25	19	32	17	9	42	23	26	24	39	14	26	**296**	**24.7**
		Total	39	29	40	26	15	53	33	35	33	51	31	31	**416**	**34.7**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		8	4	19	10	10	24	25	37	18	21	28	18	**222**	**18.5**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	1	0	3	0	4	1	0	0	1	**10**	**0.8**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		16	32	37	37	16	18	16	32	21	20	22	17	**284**	**23.7**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	1	1	0	0	0	1	0	0	0	0	0	**3**	**0.3**
PAR	*Aricidea* sp.		1	0	2	3	5	1	3	8	4	4	3	3	**37**	**3.1**
PBOC	Pseudopolydora complex		0	1	1	1	1	1	0	0	0	2	0	0	**7**	**0.6**
PCOS	*Cossura* sp.		0	0	0	5	0	0	0	1	0	0	1	0	**7**	**0.6**
PEUC	*Euchone* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
PGLY	*Glycera* sp.		2	2	2	1	1	3	0	1	1	2	0	1	**16**	**1.3**
PHF	"Capitellidae"		17	25	28	27	25	7	15	24	16	19	23	14	**240**	**20.0**
PMD	*Magelona dakini*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PNIC	Nereidae		1	0	1	1	1	0	0	3	3	2	0	1	**13**	**1.1**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	0	0	0	1	2	1	0	1	2	**7**	**0.6**
NON INDICATOR SPECIES																
CAMPH	Amphipods		3	0	0	0	1	0	2	1	1	2	1	0	**11**	**0.9**
CCRAB	Crabs		0	1	1	1	1	1	2	5	2	2	5	1	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	3	0	1	0	1	0	1	0	2	0	**8**	**0.7**
COST	Ostracods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	2	1	3	1	0	0	0	0	0	0	0	**7**	**0.6**
BOTH	Bivalves		0	0	2	0	0	0	0	0	0	0	0	0	**2**	**0.2**
GOTH	Gastropods		10	10	15	5	5	10	10	32	12	8	8	11	**136**	**11.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		1	1	1	0	1	0	2	0	1	1	1	0	**9**	**0.8**
POTH	Polychaetes		2	1	9	4	5	2	1	3	9	3	3	1	**43**	**3.6**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		1	0	3	4	0	6	2	2	1	0	1	2	**22**	**1.8**
TOTAL			**144**	**128**	**207**	**182**	**119**	**162**	**143**	**229**	**165**	**191**	**171**	**144**	**1963**	**163.6**

OB July 2004

INDICATOR SPECIES			CORE NUMBER												TOTAL	MEAN
			1	2	3	4	5	6	7	8	9	10	11	12		
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		3	3	1	2	0	0	1	0	2	1	2	1	**16**	**1.3**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	0	3	0	0	0	0	1	0	0	0	**4**	**0.3**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	3	0	0	0	0	1	0	0	0	**4**	**0.3**
BAS	*Austrovenus stutchburyi*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BML	*Macamona liliana*	<5	0	0	2	0	0	0	1	0	0	0	1	0	**4**	**0.3**
		5-15	0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
		>15	0	0	0	0	0	1	0	0	0	1	0	0	**2**	**0.2**
		Cond.analysis	0	0	1	1	0	0	1	0	1	2	1	0	**7**	**0.6**
		Total	0	0	3	2	0	1	2	0	1	3	2	0	**14**	**1.2**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
		Total	0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
CUMACEANS																
CCL	*Colurostylis lemurum*		7	1	4	4	1	3	1	2	1	3	5	1	**33**	**2.8**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0.1**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		0	2	3	2	0	1	2	1	0	1	4	0	**16**	**1.3**
PAGL	*Aglaophamus* sp.		0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
PAO	*Aonides oxycephala*		0	0	0	4	0	0	0	0	0	0	0	0	**4**	**0.3**
PAR	*Aricidea* sp.		2	0	3	1	1	0	1	1	0	0	2	0	**11**	**0.9**
PBOC	Pseudopolydora complex		0	1	12	0	0	0	0	0	0	0	0	0	**13**	**1.1**
PCOS	*Cossura* sp.		16	8	10	24	10	0	26	18	17	15	10	13	**167**	**13.9**
PEUC	*Euchone* sp.		1	2	0	2	1	1	0	2	0	3	2	1	**15**	**1.3**
PGE	*Goniada* sp.		0	1	2	0	0	0	2	1	0	0	2	1	**9**	**0.8**
PGLY	*Glycera* sp.		0	3	0	0	0	0	3	3	1	0	1	0	**11**	**0.9**
PHF	"Capitellidae"		22	33	24	16	11	7	10	9	22	12	17	25	**208**	**17.3**
PMD	*Magelona dakini*		1	0	1	0	1	0	0	0	1	0	2	0	**6**	**0.5**
PNIC	Nereidae		5	3	1	0	3	0	1	4	4	0	2	2	**25**	**2.1**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		8	4	3	2	1	0	2	5	3	1	3	3	**35**	**2.9**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	0	0	0	1	0	1	1	0	0	2	**5**	**0.4**
CCRAB	Crabs		0	0	0	1	0	1	1	0	0	0	0	0	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		1	0	0	0	0	1	0	0	2	0	0	0	**4**	**0.3**
COST	Ostracods		2	1	1	1	0	0	2	0	0	0	0	0	**7**	**0.6**
CSHR	Shrimps/Mysids		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COTH	Other Crustaceans		0	0	0	1	0	0	0	1	0	0	0	0	**2**	**0.2**
BOTH	Bivalves		0	0	2	1	0	0	1	0	1	0	1	2	**8**	**0.7**
GOTH	Gastropods		6	7	4	7	6	4	2	7	6	2	6	3	**60**	**5.0**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	1	0	**1**	**0.1**
ONEM	Nemerteans		2	1	1	0	2	0	1	0	1	1	1	1	**11**	**0.9**
POTH	Polychaetes		5	10	3	3	4	2	3	5	5	5	3	3	**51**	**4.3**
OOLIG	Oligochaetes		0	0	0	0	0	1	0	1	0	0	0	0	**2**	**0.2**
OFLAT	Flatworms		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		1	0	2	0	1	1	1	1	1	1	1	7	**17**	**1.4**
TOTAL			**82**	**81**	**80**	**77**	**43**	**24**	**62**	**62**	**70**	**49**	**67**	**65**	**759**	**63.3**

OB October 2004

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		17	3	7	6	8	13	11	11	9	4	5	3	**97**	**8.1**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	0	0	1	1	1	0	0	0	9	0	**12**	**1.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	1	1	1	0	0	0	9	0	**12**	**1.0**
BAS	*Austrovenus stutchburyi*	<5	0	0	1	1	0	0	0	0	1	0	2	3	**8**	**0.7**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	1	1	0	0	0	0	1	0	2	3	**8**	**0.7**
BML	*Macamona liliana*	<5	0	1	0	2	3	4	3	1	4	4	2	2	**26**	**2.2**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	1	0	2	3	4	3	1	4	4	2	2	**26**	**2.2**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
		Total	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.1**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.1**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		3	0	0	0	0	0	1	0	2	0	2	0	**8**	**0.7**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		39	4	0	8	6	14	9	4	4	9	1	5	**103**	**8.6**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	0	0	0	0	1	1	0	0	0	0	0	**2**	**0.2**
PAR	*Aricidea* sp.		0	0	1	2	0	1	1	0	0	4	1	0	**10**	**0.8**
PBOC	Pseudopolydora complex		0	0	0	0	0	13	0	0	0	1	0	0	**14**	**1.2**
PCOS	*Cossura* sp.		30	18	29	6	31	21	63	36	29	21	5	22	**311**	**25.9**
PEUC	*Euchone* sp.		5	7	1	3	2	1	0	3	2	3	1	4	**32**	**2.7**
PGE	*Goniada* sp.		1	0	0	0	1	1	0	0	0	0	0	0	**3**	**0.3**
PGLY	*Glycera* sp.		2	1	1	2	1	2	0	2	2	0	1	2	**16**	**1.3**
PHF	"Capitellidae"		53	12	16	20	20	25	11	18	11	24	26	31	**267**	**22.3**
PMD	*Magelona dakini*		1	0	2	0	0	1	2	0	0	0	0	0	**6**	**0.5**
PNIC	Nereidae		1	2	3	4	0	3	4	2	4	3	2	6	**34**	**2.8**
POP	*Orbinia papillosa*		1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PPAR	Paraonidae		20	4	1	0	0	8	0	1	0	0	2	5	**41**	**3.4**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	1	5	0	1	3	3	3	0	2	2	1	**21**	**1.8**
CCRAB	Crabs		4	3	4	3	0	6	0	1	1	2	3	6	**0**	**0.0**
CCUM	Cumaceans		0	0	1	0	0	0	0	0	0	1	0	0	**2**	**0.2**
CISO	Isopods		0	0	0	0	0	0	0	0	0	0	1	1	**2**	**0.2**
COST	Ostracods		1	0	1	1	1	1	0	0	0	0	0	0	**5**	**0.4**
CSHR	Shrimps/Mysids		1	5	1	4	0	1	7	0	3	6	6	6	**40**	**3.3**
COTH	Other Crustaceans		0	0	0	0	0	0	1	0	0	0	1	0	**2**	**0.2**
BOTH	Bivalves		0	0	1	1	1	3	0	3	1	2	6	4	**22**	**1.8**
GOTH	Gastropods		3	2	6	2	3	5	1	3	3	1	0	6	**35**	**2.9**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	1	0	1	0	0	1	1	0	0	0	0	**4**	**0.3**
POTH	Polychaetes		6	7	3	2	5	7	3	3	1	7	5	5	**54**	**4.5**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	4	0	0	0	0	**4**	**0.3**
OFLAT	Flatworms		0	3	0	1	0	1	1	0	1	0	1	2	**10**	**0.8**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		33	0	0	1	0	0	1	0	1	0	1	2	**39**	**3.3**
TOTAL			**221**	**74**	**84**	**70**	**84**	**136**	**125**	**97**	**79**	**94**	**85**	**117**	**1233**	**102.8**

OB January 2005

INDICATOR SPECIES			CORE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEAN
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		10	0	7	4	6	5	12	9	6	4	1	4	**68**	**5.7**
BIVALVES		**SIZE**	0	0	0	0	0	0	0	0	0	0	0	0		
BAB	*Arthritica bifurca*	<2	0	0	0	0	0	1	0	0	2	0	0	0	**3**	**0.3**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	1	0	0	2	0	0	0	**3**	**0.3**
BAS	*Austrovenus stutchburyi*	<5	0	2	0	0	0	0	0	0	0	0	0	0	**2**	**0.2**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	2	0	0	0	0	0	0	0	0	0	0	**2**	**0.2**
BML	*Macamona liliana*	<5	0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	1	0	0	0	1	0	0	0	0	0	0	0	**2**	**0.2**
		Cond.analysis	0	0	0	1	0	0	0	0	0	0	0	0	**1**	**0.1**
		Total	1	0	0	2	1	0	0	0	0	0	0	0	**4**	**0.3**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	1	1	0	0	0	0	0	**2**	**0.2**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	1	1	0	0	0	0	0	**2**	**0.2**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CUMACEANS																
CCL	*Colurostylis lemurum*		1	1	1	1	2	0	3	0	1	1	0	1	**12**	**1.0**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		5	4	3	18	8	5	9	20	8	22	28	9	**139**	**11.6**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAR	*Aricidea* sp.		1	2	2	0	4	2	4	1	1	0	5	3	**25**	**2.1**
PBOC	Pseudopolydora complex		0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.1**
PCOS	*Cossura* sp.		8	15	19	25	17	4	49	31	38	27	35	39	**307**	**25.6**
PEUC	*Euchone* sp.		0	1	0	2	2	0	0	1	1	0	1	1	**9**	**0.8**
PGE	*Goniada* sp.		0	0	0	0	2	2	0	1	1	0	0	0	**6**	**0.5**
PGLY	*Glycera* sp.		1	1	0	2	1	0	2	2	0	1	3	1	**14**	**1.2**
PHF	"Capitellidae"		17	18	20	15	17	25	19	26	31	26	24	30	**268**	**22.3**
PMD	*Magelona dakini*		0	0	0	1	1	0	0	0	1	0	0	0	**3**	**0.3**
PNIC	Nereidae		5	2	1	2	0	1	3	4	2	2	1	4	**27**	**2.3**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		0	0	0	3	0	3	0	5	0	1	2	0	**14**	**1.2**
NON INDICATOR SPECIES																
CAMPH	Amphipods		3	0	0	0	2	1	4	8	0	1	0	4	**23**	**1.9**
CCRAB	Crabs		0	0	0	0	1	0	5	0	1	0	1	1	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	4	0	0	0	0	0	**4**	**0.3**
CISO	Isopods		1	1	0	0	0	1	0	0	0	0	0	0	**3**	**0.3**
COST	Ostracods		1	1	0	0	1	1	6	2	1	0	0	0	**13**	**1.1**
CSHR	Shrimps/Mysids		0	0	0	0	0	3	1	1	0	0	0	0	**5**	**0.4**
COTH	Other Crustaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BOTH	Bivalves		1	0	1	1	0	4	12	4	2	2	2	3	**32**	**2.7**
GOTH	Gastropods		4	6	3	2	2	2	3	1	0	1	1	2	**27**	**2.3**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		0	0	1	1	0	0	1	1	1	0	0	0	**5**	**0.4**
POTH	Polychaetes		4	7	2	2	8	10	5	2	4	3	3	5	**55**	**4.6**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		0	0	1	0	0	0	0	0	1	0	1	0	**3**	**0.3**
OEDW	*Edwardsia*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER	Misc. Other		1	1	0	1	0	1	0	2	0	0	0	0	**6**	**0.5**
TOTAL			**64**	**62**	**61**	**82**	**75**	**72**	**144**	**121**	**102**	**91**	**108**	**107**	**1080**	**90.0**

OB April 2005

INDICATOR SPECIES		SIZE	CORE NUMBER												TOTAL	MEAN
			1	2	3	4	5	6	7	8	9	10	11	12		
AMPHIPODS																
ACOR	*Corophiidae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
APHOX	*Phoxocephalidae*		5	2	3	1	1	2	4	2	6	7	6	4	**43**	**3.6**
BIVALVES		**SIZE**														
BAB	*Arthritica bifurca*	<2	0	0	1	3	0	0	1	0	4	1	1	4	**15**	**1.3**
		>2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	1	3	0	0	1	0	4	1	1	4	**15**	**1.3**
BAS	*Austrovenus stutchburyi*	<5	0	0	1	0	0	0	0	0	0	0	0	1	**2**	**0.2**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Cond.analysis	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	1	0	0	0	0	0	0	0	0	1	**2**	**0.2**
BML	*Macamona liliana*	<5	0	1	0	0	0	1	0	0	0	1	1	0	**4**	**0.3**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	1	0	0	1	0	0	0	0	0	0	0	0	**2**	**0.2**
		Cond.analysis	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
		Total	2	1	0	1	0	1	0	0	0	1	1	0	**7**	**0.6**
BNH	*Nucula hartvigiana*	<2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>2	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
		Total	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.1**
BPA	*Paphies australis*	<5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		5-15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		>15	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
BTHL	*Theora lubrica*	<5	0	0	1	0	0	0	0	0	0	0	1	0	**2**	**0.2**
		>5	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
		Total	0	0	1	0	0	0	0	0	0	0	1	0	**2**	**0.2**
CUMACEANS																
CCL	*Colurostylis lemurum*		6	2	3	1	2	0	0	0	0	0	4	3	**21**	**1.8**
GASTROPODS																
GCA	*Cominella adspera*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GNHE	*Notoacmea* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OTHER																
OAN	*Anthopleura aureoradiata*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
POLYCHAETES																
PAA	*Aquilaspio aucklandica*		14	16	22	11	11	6	9	12	13	6	13	21	**154**	**12.8**
PAGL	*Aglaophamus* sp.		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PAO	*Aonides oxycephala*		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
PAR	*Aricidea* sp.		1	0	1	0	6	0	2	1	1	0	4	1	**17**	**1.4**
PBOC	Pseudopolydora complex		1	0	0	0	2	0	0	0	1	0	0	0	**4**	**0.3**
PCOS	*Cossura* sp.		16	12	22	14	38	21	23	48	28	27	16	32	**297**	**24.8**
PEUC	*Euchone* sp.		5	4	0	0	0	0	1	3	0	0	1	4	**18**	**1.5**
PGE	*Goniada* sp.		0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.1**
PGLY	*Glycera* sp.		0	2	0	0	0	0	2	2	2	0	0	0	**8**	**0.7**
PHF	"Capitellidae"		29	27	40	19	29	13	23	19	19	23	25	25	**291**	**24.3**
PMD	*Magelona dakini*		0	2	1	0	1	2	0	0	0	2	1	1	**10**	**0.8**
PNIC	Nereidae		2	1	3	2	4	1	2	3	4	1	2	5	**30**	**2.5**
POP	*Orbinia papillosa*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
PPAR	Paraonidae		2	2	1	2	2	5	1	0	10	0	2	7	**34**	**2.8**
NON INDICATOR SPECIES																
CAMPH	Amphipods		0	0	3	1	2	0	1	2	1	3	0	2	**15**	**1.3**
CCRAB	Crabs		0	1	1	3	0	2	0	0	1	0	2	2	**0**	**0.0**
CCUM	Cumaceans		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
CISO	Isopods		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
COST	Ostracods		0	3	0	0	1	0	0	0	0	1	2	1	**8**	**0.7**
CSHR	Shrimps/Mysids		3	0	0	2	0	0	0	2	4	1	1	1	**14**	**1.2**
COTH	Other Crustaceans		0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.1**
BOTH	Bivalves		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
GOTH	Gastropods		6	7	7	6	3	4	3	3	5	9	11	3	**67**	**5.6**
EFEZ	*Fellaster zealandiae*		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
EHOL	Holuthurians		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
ONEM	Nemerteans		3	0	0	0	0	0	2	2	0	0	0	1	**8**	**0.7**
POTH	Polychaetes		0	4	5	8	2	1	1	1	5	2	3	4	**36**	**3.0**
OOLIG	Oligochaetes		0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**
OFLAT	Flatworms		1	1	0	1	1	0	0	0	0	0	0	2	**6**	**0.5**
OEDW	*Edwardsia*		0	0	1	0	0	1	1	0	0	0	0	0	**3**	**0.3**
OTHER	Misc. Other		2	1	0	0	1	0	0	1	1	0	2	2	**10**	**0.8**
TOTAL			**98**	**90**	**116**	**75**	**106**	**59**	**76**	**101**	**106**	**85**	**98**	**126**	**1124**	**93.7**

Appendix 3 – Dry weight shell-hash

Southern Firth of Thames

July

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
MI	1	9.7	175.6	165.9
	2	9.7	218.0	208.3
	3	9.9	133.2	123.3
	4	10.0	244.4	234.4
	5	9.9	184.8	174.9
	6	10.0	238.1	228.1
	7	9.6	228.2	218.6
	8	9.7	204.8	195.1
	9	9.7	207.3	197.6
	10	9.7	232.9	223.2
	11	10.0	219.8	209.8
	12	9.9	456.8	446.9
KB	1	9.7	180.4	170.7
	2	9.9	260.0	250.1
	3	10.0	281.7	271.7
	4	10.1	218.8	208.7
	5	10.1	223.4	213.3
	6	10.2	200.7	190.5
	7	9.7	226.1	216.4
	8	10.5	148.5	138.0
	9	9.8	224.0	214.2
	10	9.9	228.2	218.3
	11	9.8	169.2	159.4
	12	9.7	235.3	225.6

Whaingaroa Harbour

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
WI	1	10.1	85.0	74.9
	2	9.7	215.2	205.5
	3	10.2	376.3	366.1
	4	10.0	128.1	118.1
	5	10.0	177.4	167.4
	6	10.0	131.7	121.7
	7	9.8	134.4	124.6
	8	9.8	137.4	127.6
	9	10.0	119.8	109.8
	10	10.0	154.3	144.3
	11	10.0	141.4	131.4
	12	10.0	174.5	164.5
OB	1	9.8	118.2	108.4
	2	9.8	86.4	76.6
	3	10.0	74.4	64.4
	4	10.0	54.0	44.0
	5	10.0	87.2	77.2
	6	10.0	103.7	93.7
	7	9.7	87.9	78.2
	8	9.7	93.6	83.9
	9	9.8	74.1	64.3
	10	9.8	53.4	43.6
	11	9.9	75.4	65.5
	12	9.9	133.5	123.6

Southern Firth of Thames

October 2004

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
KA	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	9.9	46.4	36.5
	4	9.8	53.5	43.7
	5	9.8	44.5	34.7
	6	9.8	127.2	117.4
	7	10.0	95.6	85.6
	8	10.1	161.1	151.0
	9	10.0	60.4	50.4
	10	10.2	142.8	132.6
	11	9.7	121.3	111.6
	12	10.2	107.6	97.4
GC	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	29.4	1296.6	1267.2
	4	20.2	879.2	859.0
	5	19.6	766.4	746.8
	6	20.2	695.0	674.8
	7	29.3	1282.3	1253.0
	8	9.8	421.9	412.1
	9	19.8	537.1	517.3
	10	20.2	593.7	573.5
	11	39.5	1448.6	1409.1
	12	20.1	598.6	578.5
TP	1	FORMALIN SAMPLE		
	2	10.1	99.0	88.9
	3	10.1	167.1	157.0
	4	9.9	84.7	74.8
	5	10.0	37.8	27.8
	6	10.1	86.7	76.6
	7	10.2	26.6	16.4
	8	9.8	64.7	54.9
	9	9.7	55.8	46.1
	10	10.1	55.6	45.5
	11	9.5	69.0	59.5
	12	9.8	271.4	261.6
MI	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	9.7	234.7	225.0
	4	9.8	341.3	331.5
	5	10.2	348.0	337.8
	6	10.0	196.9	186.9
	7	9.9	268.2	258.3
	8	9.7	248.6	238.9
	9	10.0	211.7	201.7
	10	10.1	182.2	172.1
	11	9.7	231.4	221.7
	12	9.8	246.6	236.8
KB	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	10.4	283.8	273.4
	4	10.6	157.1	146.5
	5	9.7	199.3	189.6
	6	9.7	192.9	183.2
	7	9.7	163.8	154.1
	8	10.4	180.2	169.8
	9	10.0	200.2	190.2
	10	10.0	144.1	134.1
	11	10.0	212.8	202.8
	12	10.0	155.0	145.0

Whaingaroa Harbour

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
TU	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	9.8	188.6	178.8
	4	9.9	110.4	100.5
	5	10.0	173.0	163.0
	6	9.7	150.0	140.3
	7	9.8	110.8	101.0
	8	10.2	132.0	121.8
	9	10.0	139.4	129.4
	10	9.7	150.0	140.3
	11	10.3	133.4	123.1
	12	9.7	124.2	114.5
HB	1	FORMALIN SAMPLE		
	2	9.8	139.7	129.9
	3	10.0	138.6	128.6
	4	10.1	130.2	120.1
	5	9.9	155.2	145.3
	6	9.8	235.9	226.1
	7	10.2	315.2	305.0
	8	10.0	294.3	284.3
	9	9.8	159.3	149.5
	10	10.4	153.9	143.5
	11	9.8	128.6	118.8
	12	10.3	177.2	166.9
X	1	FORMALIN SAMPLE		
	2	10.0	323.7	313.7
	3	10.0	209.7	199.7
	4	9.7	175.3	165.6
	5	9.8	103.6	93.8
	6	9.8	431.4	421.6
	7	9.7	415.4	405.7
	8	10.0	229.2	219.2
	9	9.6	131.0	121.4
	10	10.1	363.7	353.6
	11	9.9	388.0	378.1
	12	10.0	169.4	159.4
WI	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	9.4	80.0	70.6
	4	10.0	140.5	130.5
	5	9.7	246.7	237.0
	6	9.7	121.7	112.0
	7	10.2	142.6	132.4
	8	9.9	233.3	223.4
	9	10.0	277.4	267.4
	10	9.7	398.5	388.8
	11	10.0	257.2	247.2
	12	9.8	398.5	388.7
OB	1	FORMALIN SAMPLE		
	2	FORMALIN SAMPLE		
	3	9.4	52.4	43.0
	4	10	105.8	95.8
	5	9.8	84.4	74.6
	6	9.7	31.4	21.7
	7	10.2	40.6	30.4
	8	10.0	55.2	45.2
	9	10.0	18.4	8.4
	10	9.7	81.3	71.6
	11	10.0	89.9	79.9
	12	9.8	107.0	97.2

Southern Firth of Thames

Whaingaroa Harbour

January 2005

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
MI	1	9.8	155.3	145.5
	2	9.7	127.8	118.1
	3	10.1	172.0	161.9
	4	9.7	204.5	194.8
	5	10.1	234.8	224.7
	6	10.0	172.5	162.5
	7	10.1	243.3	233.2
	8	10.0	158.1	148.1
	9	9.8	149.8	140.0
	10	9.7	113.8	104.1
	11	10.0	155.3	145.3
	12	10.0	239.7	229.7
KB	1	9.8	261.7	251.9
	2	10.0	194.1	184.1
	3	10.0	213.5	203.5
	4	9.9	180.0	170.1
	5	9.9	210.2	200.3
	6	10.2	171.1	160.9
	7	10.2	177.5	167.3
	8	9.8	154.7	144.9
	9	10.3	166.7	156.4
	10	9.8	117.2	107.4
	11	9.4	180.3	170.9
	12	10.0	164.0	154.0

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
WI	1	10.0	148.0	138.0
	2	10.2	113.2	103.0
	3	9.9	127.4	117.5
	4	10.1	171.1	161.0
	5	10.2	161.4	151.2
	6	9.8	160.4	150.6
	7	9.7	159.3	149.6
	8	9.7	165.5	155.8
	9	10.0	108.0	98.0
	10	10.0	190.4	180.4
	11	10.2	183.8	173.6
	12	9.8	141.5	131.7
OB	1	10.1	89.1	79.0
	2	10.0	133.1	123.1
	3	9.8	81.8	72.0
	4	9.8	71.6	61.8
	5	10.1	83.7	73.6
	6	10.1	74.4	64.3
	7	10.1	48.0	37.9
	8	9.8	54.5	44.7
	9	9.7	30.4	20.7
	10	10.0	60.6	50.6
	11	9.7	52.8	43.1
	12	9.5	57.9	48.4

Southern Firth of Thames

April 2005

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
KA	1	10.1	96.6	86.5
	2	9.8	77.6	67.8
	3	10.1	133.8	123.7
	4	10.2	76.5	66.3
	5	9.9	237.1	227.2
	6	9.7	106.1	96.4
	7	9.7	58.2	48.5
	8	10	129.7	119.7
	9	10	62.9	52.9
	10	9.8	55.4	45.6
	11	10.1	89.7	79.6
	12	9.9	175.5	165.6
GC	1	20	974.4	954.4
	2	20.4	608.7	588.3
	3	20.7	827.7	807
	4	19.5	1014.9	995.4
	5	20.1	625.3	605.2
	6	29.7	1478.9	1449.2
	7	20	1191.5	1171.5
	8	20.5	771.5	751
	9	19.8	982.9	963.1
	10	29.9	1285.5	1255.6
	11	20.5	858	837.5
	12	19.6	811.2	791.6
TP	1	9.8	154.2	144.4
	2	10	124.8	114.8
	3	10.1	70.7	60.6
	4	10.1	57.3	47.2
	5	9.7	98.9	89.2
	6	10.2	187.1	176.9
	7	10	46.5	36.5
	8	10.2	71	60.8
	9	9.8	141.1	131.3
	10	9.8	60.6	50.8
	11	9.5	114.8	105.3
	12	9.8	54.5	44.7
MI	1	10	217.1	207.1
	2	9.7	126.4	116.7
	3	9.7	171.3	161.6
	4	9.8	148.7	138.9
	5	9.7	198.4	188.7
	6	19.7	434.9	415.2
	7	9.8	345.1	335.3
	8	10.1	218.4	208.3
	9	10.1	234.6	224.5
	10	10.3	167.4	157.1
	11	10	241.7	231.7
	12	10.2	381	370.8
KB	1	9.7	227.5	217.8
	2	9.5	254.2	244.7
	3	10	177.4	167.4
	4	9.8	224.4	214.6
	5	10.1	218.5	208.4
	6	10.3	210.9	200.6
	7	10.1	210.2	200.1
	8	10.2	156	145.8
	9	9.7	152	142.3
	10	9.9	176.7	166.8
	11	9.8	101.5	91.7
	12	10.2	180.2	170

Whaingaroa Harbour

Site	Sample No.	Initial tray weight	Final weight	Shell hash weight (g)
TU	1	10.3	116.9	106.6
	2	9.7	197.9	188.2
	3	10.1	93.7	83.6
	4	9.5	126.9	117.4
	5	10	79.9	69.9
	6	10.2	67.1	56.9
	7	9.9	175.5	165.6
	8	9.9	401.1	391.2
	9	10.2	79.2	69
	10	10	70.3	60.3
	11	9.8	132.1	122.3
	12	19.9	541.3	521.4
HB	1	9.9	222.6	212.7
	2	9.9	217.1	207.2
	3	10	125.5	115.5
	4	10.1	279.7	269.6
	5	10	288.2	278.2
	6	9.8	175.3	165.5
	7	9.7	263.6	253.9
	8	9.7	273.9	264.2
	9	9.8	239.9	230.1
	10	9.9	108.7	98.8
	11	10.1	124.4	114.3
	12	9.9	160.4	150.5
X	1	9.8	109.5	99.7
	2	10.2	155.4	145.2
	3	10	304.5	294.5
	4	10	293.9	283.9
	5	9.7	91.1	81.4
	6	9.7	177.6	167.9
	7	10.1	180.7	170.6
	8	9.7	249	239.3
	9	9.7	219.1	209.4
	10	10.1	151.3	141.2
	11	10.1	140.5	130.4
	12	10.2	278.6	268.4
WI	1	9.8	59.3	49.5
	2	9.8	133.5	123.7
	3	10.1	136	125.9
	4	9.7	149.5	139.8
	5	9.5	155.4	145.9
	6	10	94.1	84.1
	7	9.8	117.7	107.9
	8	10	195.5	185.5
	9	10.4	149.5	139.1
	10	10.1	371.8	361.7
	11	9.8	178.2	168.4
	12	10.3	197.1	186.8
OB	1	9.8	100.4	90.6
	2	10.3	63.5	53.2
	3	9.7	73.8	64.1
	4	10.5	80.1	69.6
	5	9.8	44	34.2
	6	10.6	56.3	45.7
	7	10	83.3	73.3
	8	10.3	49.2	38.9
	9	10.1	59.4	49.3
	10	10	51.6	41.6
	11	10.2	69.8	59.6
	12	10.2	64.8	54.6

Appendix 4 – Sediment organic matter content

Southern Firth of Thames

Whaingaroa Harbour

July 2004

Southern Firth of Thames

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
MI	0.33	64.1	0.06
	0.33	59.7	0.06
	0.37	63.9	0.08
	0.34	65.6	0.06
	0.35	65.5	0.06
KB	0.28	64.1	< 0.05
	0.3	63.8	0.05
	0.35	61.8	0.06
	0.32	61.5	0.06
	0.25	72.2	< 0.05

Whaingaroa Harbour

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
WI	2.23	73	0.06
	0.72	66.8	0.07
	0.53	63.4	0.06
	0.54	68.1	< 0.05
	0.49	69.7	0.05
OB	0.7	52.4	0.1
	1.42	35.3	0.2
	0.87	46.5	0.12
	0.85	45.9	0.11
	0.65	53	0.09

October 2004

Southern Firth of Thames

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
KA	0.7	58.5	0.06
	0.44	56.4	0.07
	0.74	46.1	0.1
	0.32	63.3	0.06
	0.28	64	< 0.05
GC	0.55	62.1	0.05
	0.21	71.7	< 0.05
	0.22	68.5	< 0.05
	0.29	64	0.05
	0.2	67.8	< 0.05
TP	0.15	70.4	< 0.05
	0.18	68.5	< 0.05
	0.15	67.2	< 0.05
	0.17	70.4	< 0.05
	0.17	69.8	< 0.05
MI	0.28	68.2	< 0.05
	0.34	70	0.05
	0.31	65.6	< 0.05
	0.27	67.5	< 0.05
	0.25	67.1	< 0.05
KB	0.38	60.3	0.06
	0.44	59.3	0.07
	0.41	59.7	0.07
	0.43	63.3	0.07
	0.41	62.7	0.07

Whaingaroa Harbour

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
TU	0.33	73	0.05
	0.44	70.8	0.07
	0.4	71.2	0.07
	0.45	68.2	0.07
	0.34	71.5	0.06
HB	0.7	52.8	0.09
	0.66	52.5	0.09
	0.72	51.2	0.09
	0.74	55.6	0.09
	0.73	54.1	0.09
X	0.53	66.4	0.07
	0.47	71.8	0.07
	0.32	71.4	0.05
	0.32	70.9	0.05
	0.44	71.4	0.07
WI	0.47	58.5	0.07
	0.48	67.1	0.09
	0.54	63.8	0.08
	0.44	65	0.07
	0.39	67.4	0.06
OB	0.73	52.4	0.1
	0.78	52	0.1
	0.75	51.9	0.1
	0.71	52.7	0.1
	0.72	52.5	0.09

January 2005

Southern Firth of Thames

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
MI	0.23	72.8	0.09
	0.16	73.4	0.06
	0.18	73.2	0.05
	0.18	73.6	0.05
	0.23	71	0.07
KB	0.33	62.6	0.1
	0.36	63.9	0.11
	0.35	64.8	0.1
	0.46	62	0.13
	0.49	63.1	0.1

Whaingaroa Harbour

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
WI	0.47	70.3	0.1
	0.44	66.6	0.09
	0.53	66.7	0.11
	0.38	68.7	0.08
	0.49	64.3	0.11
OB	0.5	63.1	0.09
	0.51	65.6	0.09
	0.51	61.8	0.1
	0.48	62.1	0.09
	0.49	63.8	0.09

Southern Firth of Thames

Whaingaroa Harbour

April 2005

Southern Firth of Thames

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
KA	0.31	64.5	0.07
	0.32	66.6	0.08
	0.28	68.2	0.07
	0.29	67.9	0.07
	0.34	66.3	0.09
GC	0.57	65	0.09
	0.37	64.5	0.06
	0.59	64.5	0.1
	0.43	65.8	0.07
	0.53	66.1	0.08
TP	0.2	65.7	0.06
	0.15	68.7	0.05
	0.18	64.3	< 0.05
	0.15	69.3	< 0.05
	0.19	67	< 0.05
MI	0.22	71.6	< 0.05
	0.2	69	< 0.05
	0.25	69.8	0.05
	0.24	71.5	< 0.05
	0.24	71.8	0.08
KB	0.29	66.5	0.08
	0.34	66.9	0.09
	0.32	69.2	0.08
	0.3	68.2	0.08
	0.31	65.3	0.08

Whaingaroa Harbour

	Total Organic Carbon g/100g dry wt	Dry Matter g/100g as rcvd	Total Nitrogen g/100g dry wt
TU	0.51	68.8	0.09
	0.54	65.7	0.08
	0.43	72.4	0.08
	0.47	69.3	0.08
	0.46	71	0.08
HB	0.77	54	0.13
	0.71	57	0.12
	0.72	58.7	0.12
	0.76	59.8	0.12
	0.7	61.4	0.11
X	0.34	71.5	0.06
	0.39	68.9	0.07
	0.38	68.5	0.07
	0.3	71.9	0.07
	0.38	71.5	0.07
WI	0.49	61.7	0.08
	0.43	63.5	0.09
	0.45	68.9	0.09
	1.38	63.8	0.34
	0.37	67.3	0.07
OB	0.52	65.8	0.09
	0.68	67.5	0.1
	0.63	63.8	0.11
	0.49	66.7	0.09
	0.51	64.4	0.09

Appendix 5 – Sediment photosynthetic pigment concentration

Southern Firth of Thames

July 2004

	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
MI	29.80	30.90
	17.10	8.20
	21.60	13.80
	15.60	2.60
	17.40	2.60
KB	7.90	2.50
	8.00	0.40
	6.30	2.10
	8.60	0.80
	15.00	12.40

October 2004

	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
KA	7.80	2.80
	6.30	< 0.1
	9.20	< 0.1
	7.80	< 0.1
	7.20	2.20
GC	20.30	1.10
	14.00	< 0.1
	14.60	< 0.1
	15.10	0.30
	21.20	1.10
TP	7.50	< 0.1
	2.00	0.40
	5.90	0.60
	4.70	2.70
	1.90	1.20
MI	5.90	1.10
	6.10	2.00
	5.80	0.50
	9.60	3.40
	19.40	11.40
KB	6.70	1.00
	9.90	2.30
	15.60	7.80
	9.70	< 0.1
	13.80	1.60

January 2005

	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
MI	7.70	1.30
	8.00	1.10
	5.50	0.30
	6.40	1.90
	6.70	0.50
KB	12.00	0.30
	12.50	2.70
	11.90	1.10
	8.60	1.60
	15.50	4.10

Whaingaroa Harbour

July 2004

	Chlorophyll-*a* mg.g^{-1}	Pheophytin mg.g^{-1}
WI	14.90	4.30
	12.20	5.00
	17.10	4.00
	16.00	4.00
	19.40	3.40
OB	12.10	2.10
	12.10	4.40
	12.00	2.80
	10.80	0.70
	12.70	0.90

October 2004

	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
TU	15.40	2.80
	18.40	7.70
	27.20	9.50
	25.80	4.90
	32.30	0.50
HB	19.30	0.70
	18.20	2.50
	18.00	4.50
	18.40	3.00
	16.40	2.70
X	14.60	3.2
	27.40	1.2
	24.70	11.3
	20.00	5.5
	13.10	2.7
WI	21.10	4.70
	14.10	9.40
	16.20	6.70
	30.10	5.80
	15.50	7.30
OB	15.80	3.90
	14.20	3.60
	10.30	3.80
	17.90	8.10
	15.50	6.10

January 2005

	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
WI	31.00	6.10
	21.40	7.40
	16.00	7.80
	18.80	4.40
	21.10	4.40
OB	14.10	4.00
	14.00	2.50
	13.40	2.60
	15.00	2.60
	14.60	1.20

Southern Firth of Thames

April 2005

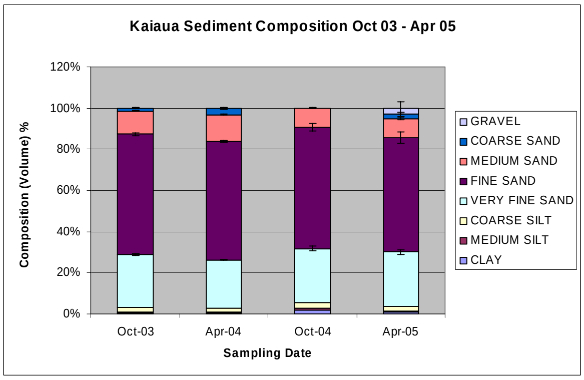
	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
KA	12.80	14.50
	8.90	8.40
	8.00	6.80
	9.30	11.00
	10.70	13.10
GC	13.50	3.00
	20.10	2.30
	22.60	3.70
	18.90	7.80
	15.20	3.70
TP	7.50	1.80
	1.30	1.10
	1.70	1.80
	9.40	1.80
	0.80	1.00
MI	7.30	4.80
	7.10	3.10
	8.90	3.30
	8.70	2.70
	7.00	4.00
KB	13.00	19.10
	8.50	7.50
	11.30	2.40
	11.00	3.40
	10.20	4.90

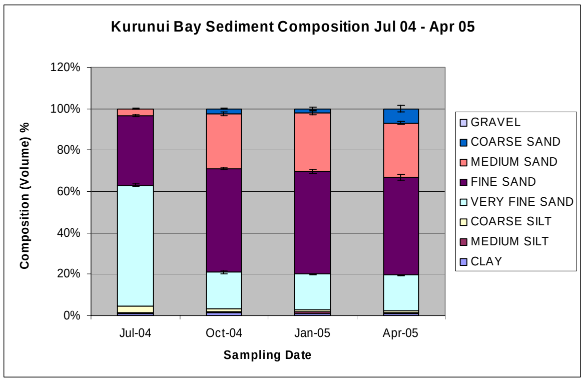
Whaingaroa Harbour

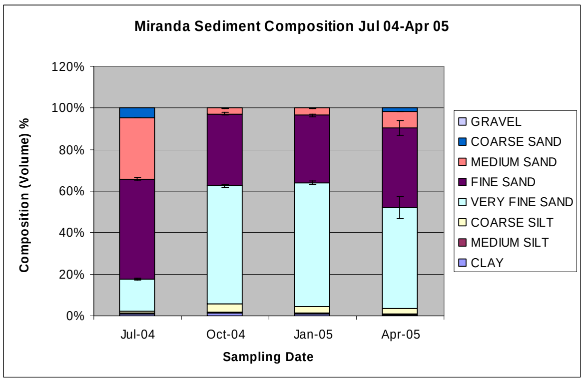
	Chlorophyll-*a* mg.kg^{-1}	Pheophytin mg.kg^{-1}
TU	29.80	5.10
	20.80	9.10
	30.60	0.60
	18.50	7.10
	26.20	12.60
HB	16.90	7.00
	17.90	5.70
	21.20	8.60
	18.30	8.60
	17.00	9.00
X	21.70	3.80
	23.80	6.10
	18.70	5.00
	16.20	3.50
	22.40	4.90
WI	14.10	7.80
	15.40	12.30
	20.50	7.20
	15.50	9.10
	14.20	7.80
OB	12.80	6.10
	11.50	11.50
	12.20	12.20
	9.30	5.60
	14.30	3.80

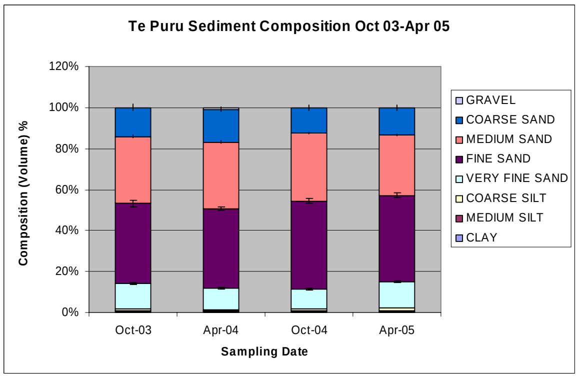
Appendix 6 – Sediment Composition & Grain Size Distribution

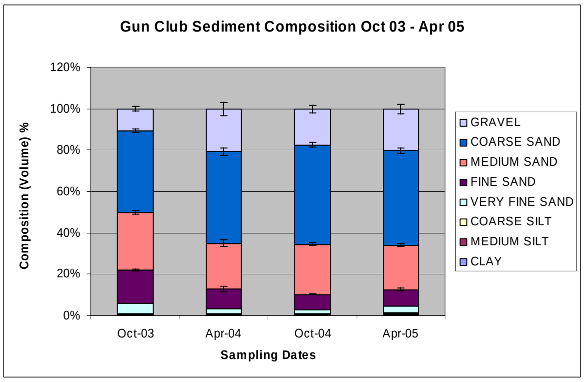
Sediment Composition – Firth of Thames[8]





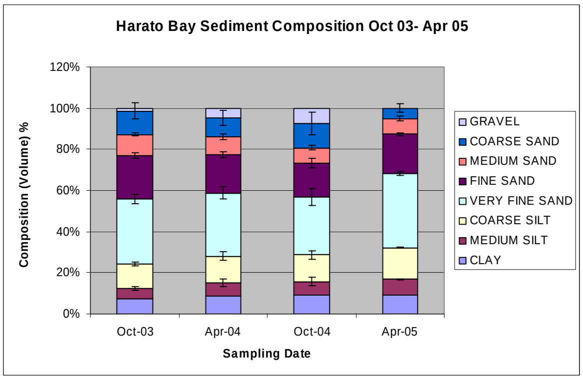


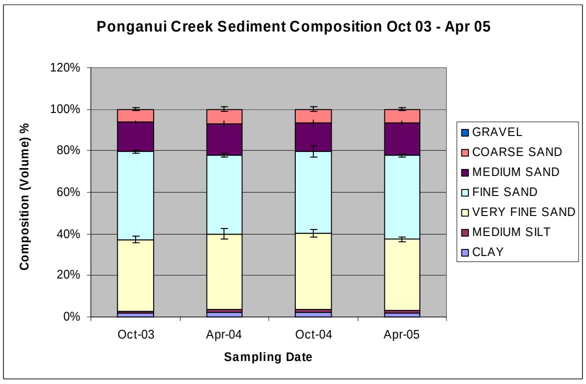


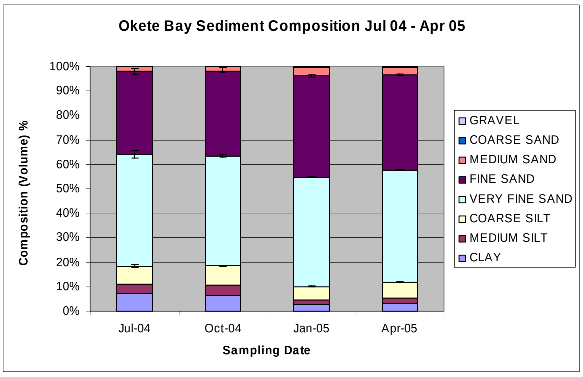


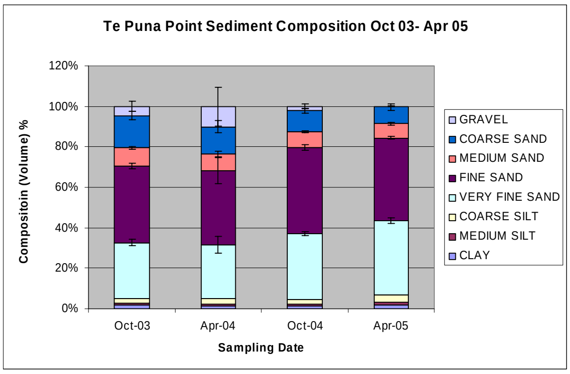
[8] The previous year's data has been provided to add context to the results presented in this report.

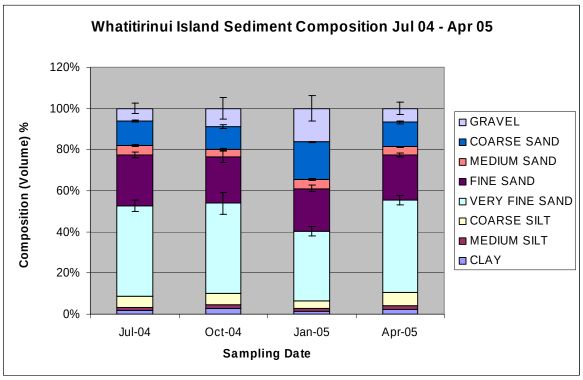
Sediment Composition - Whaingaroa (Raglan) Harbour[9]





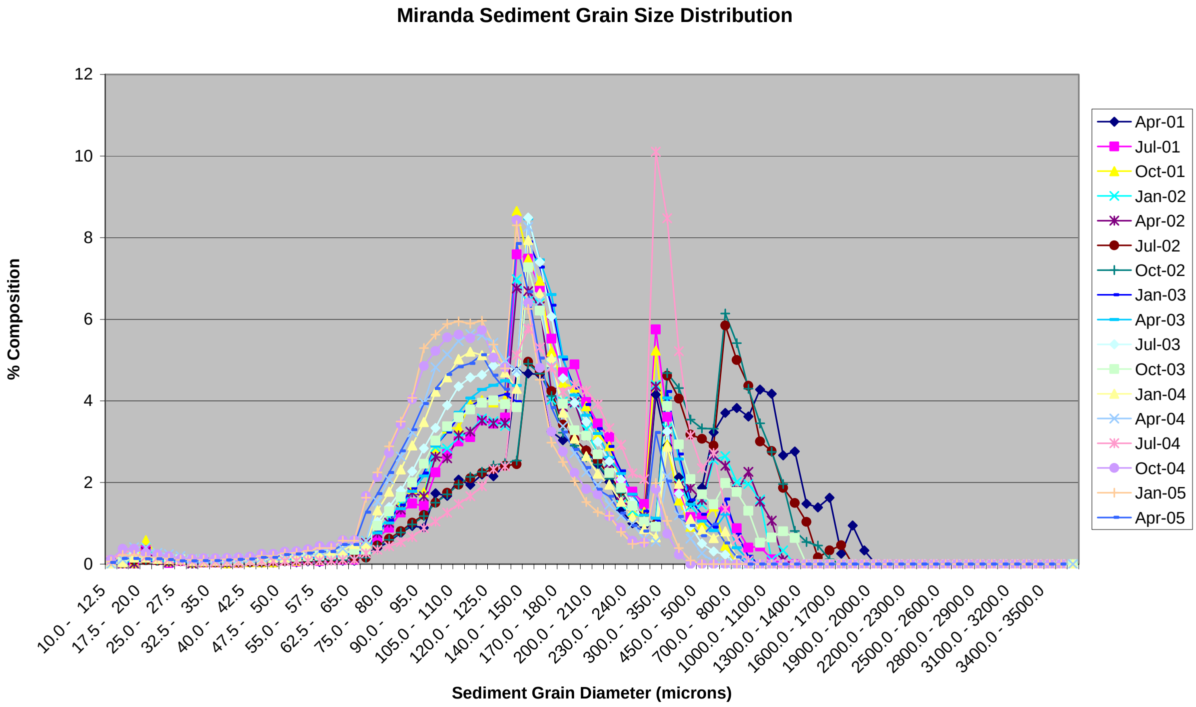


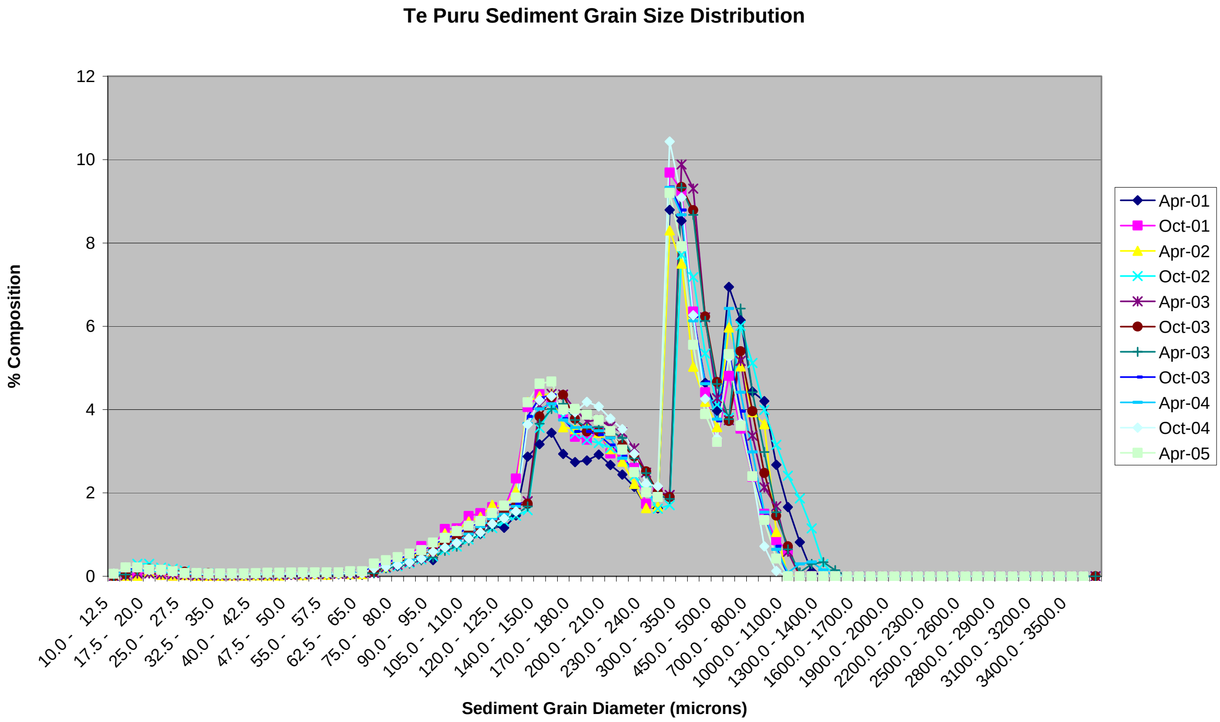




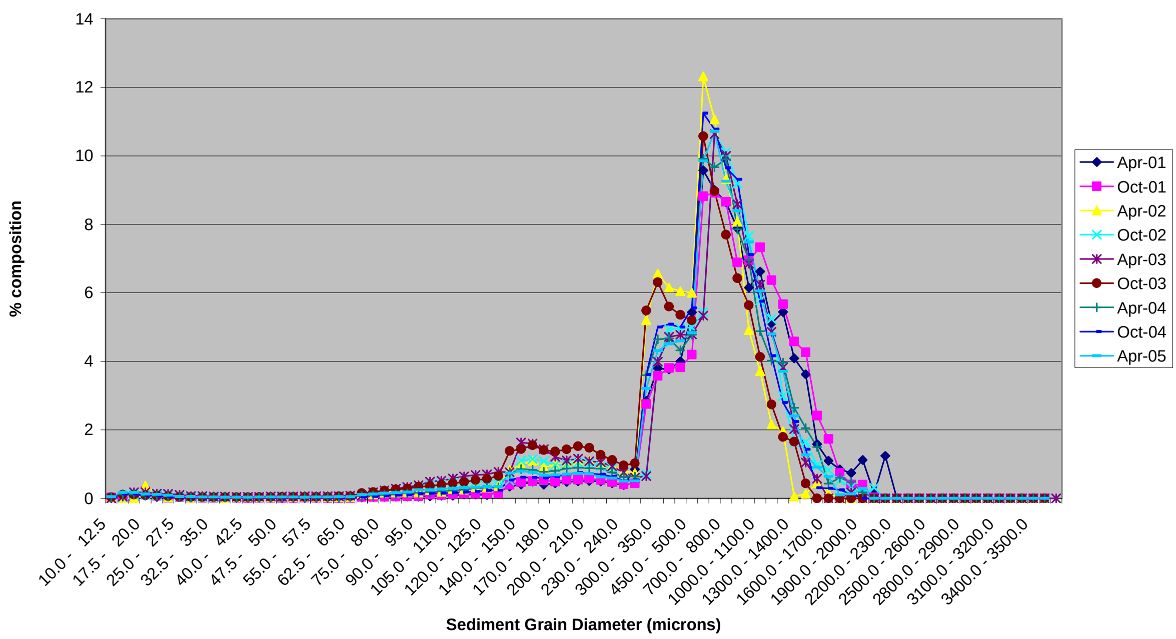
9 The previous year's data has been provided to add context to the results presented in this report.

Sediment Grain Size Distribution - Firth of Thames

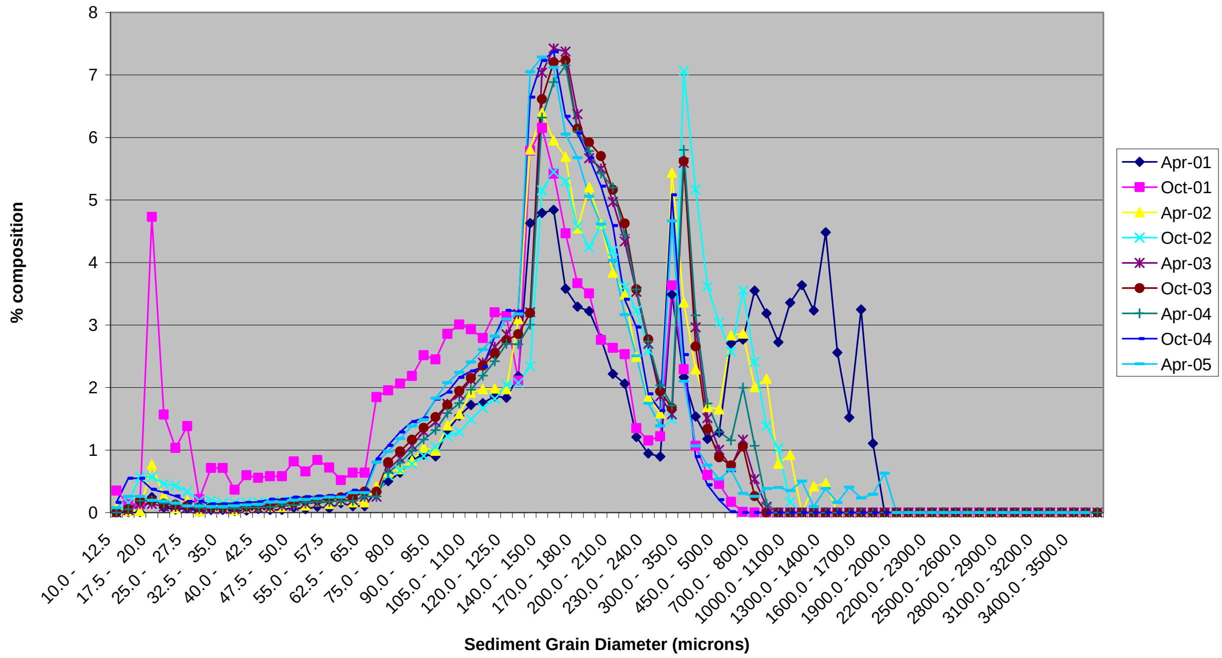


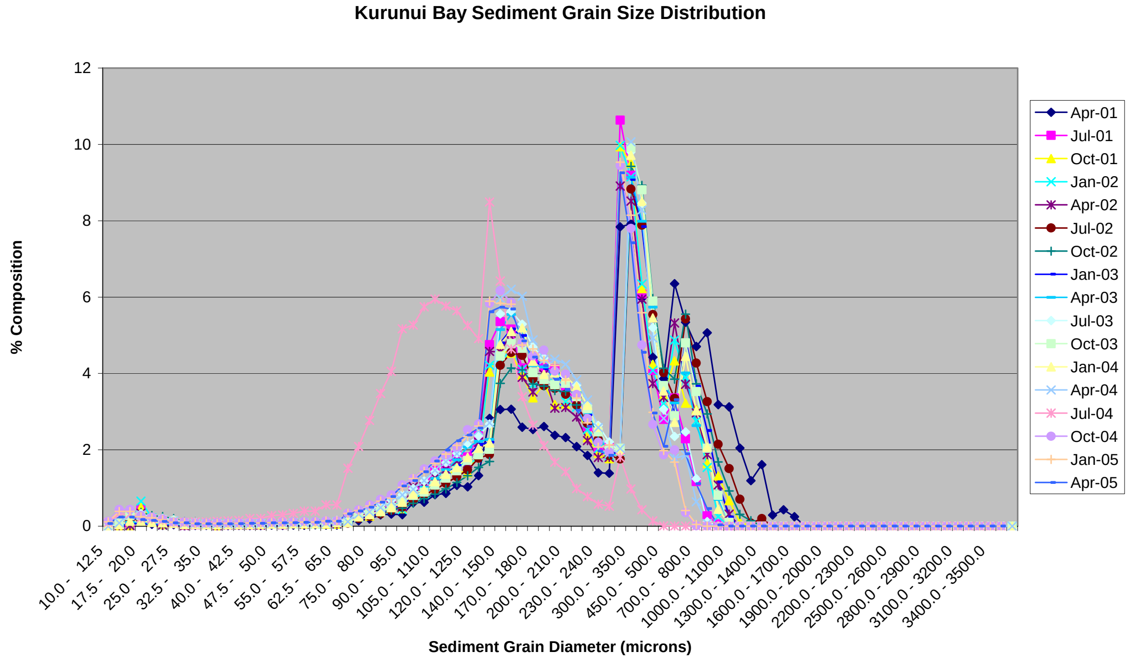


Gun Club Sediment Grain Size Distribution

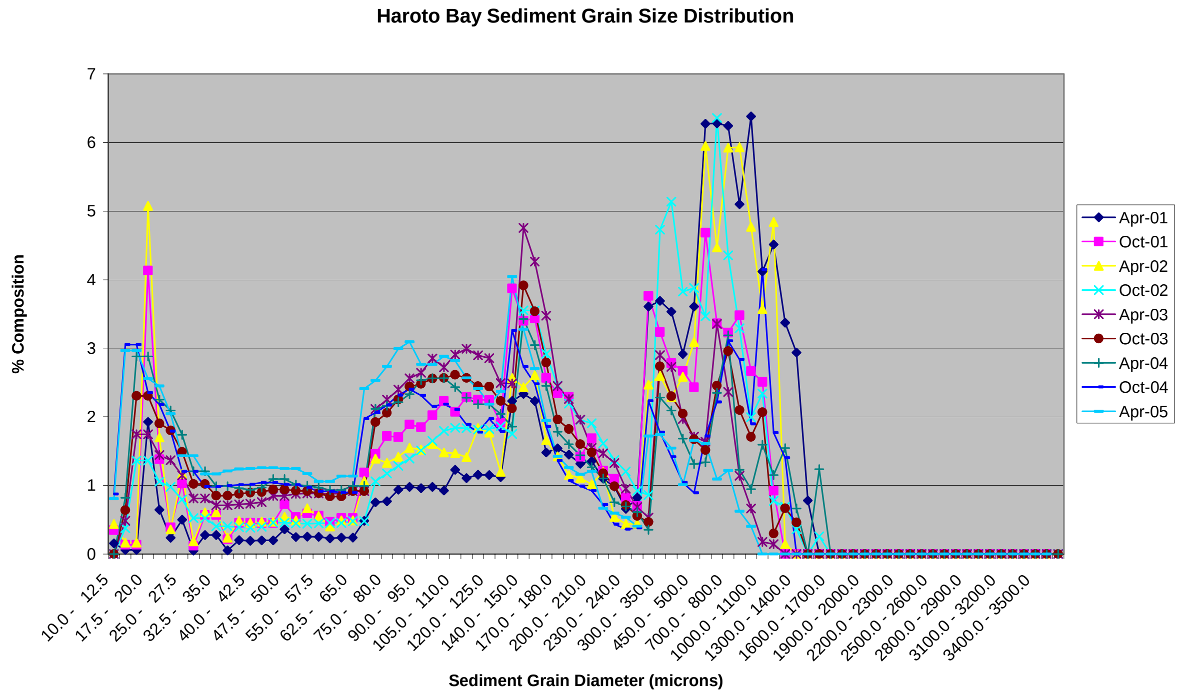


Kaiaua Sediment Grain Size Distribution

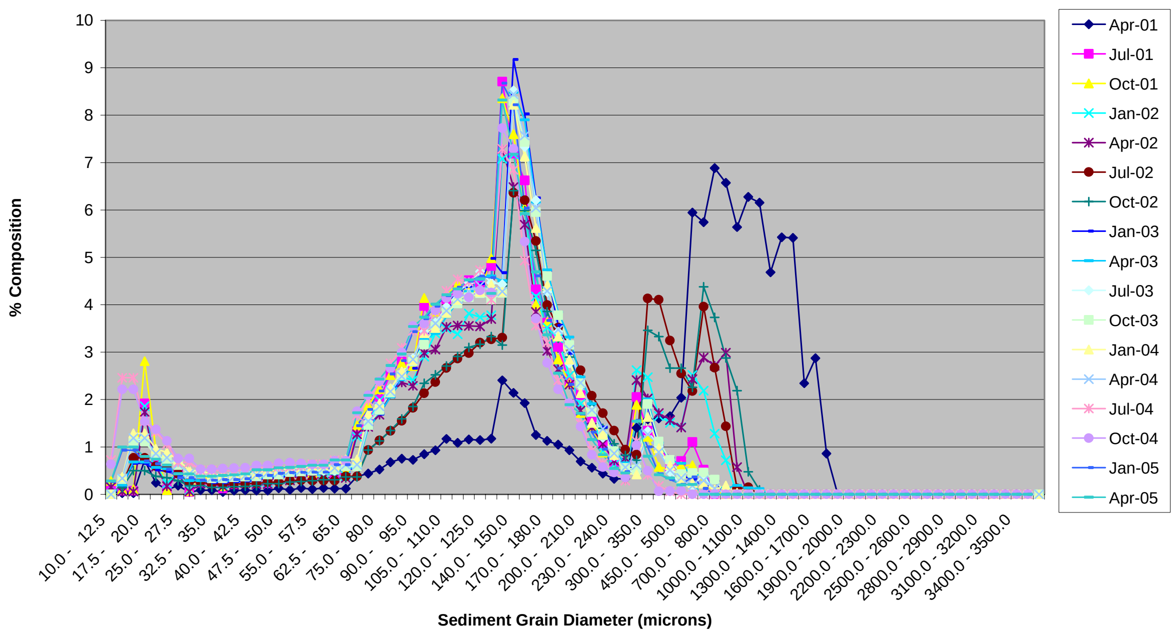




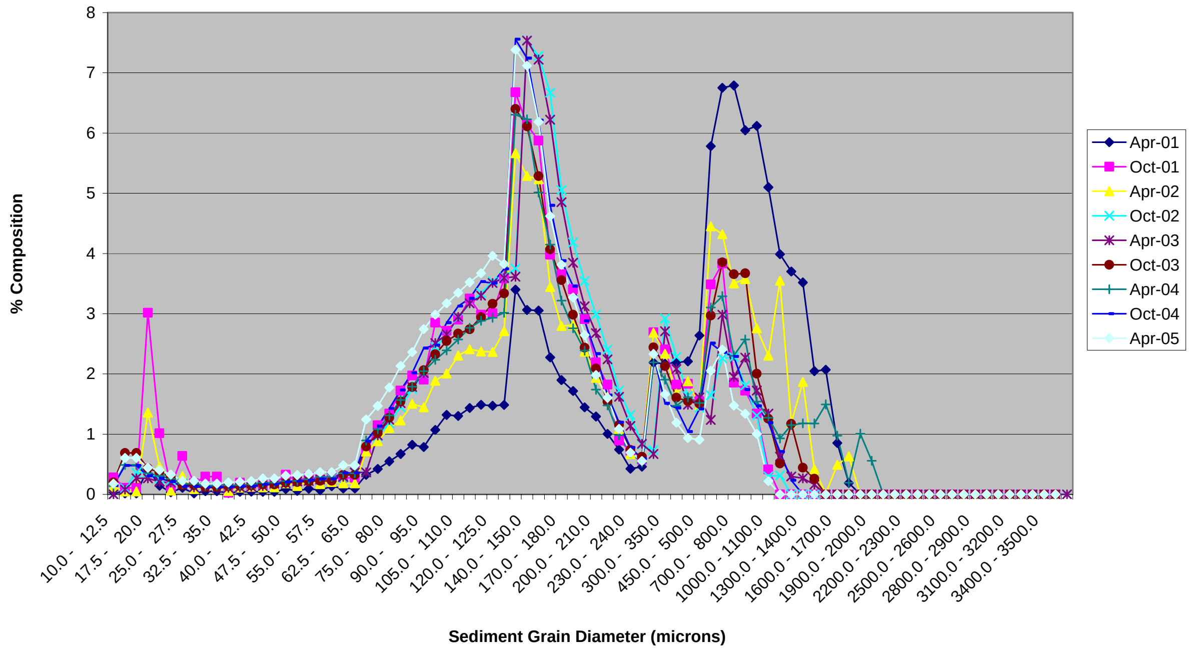
Sediment Grain Size Distribution - Raglan Harbour

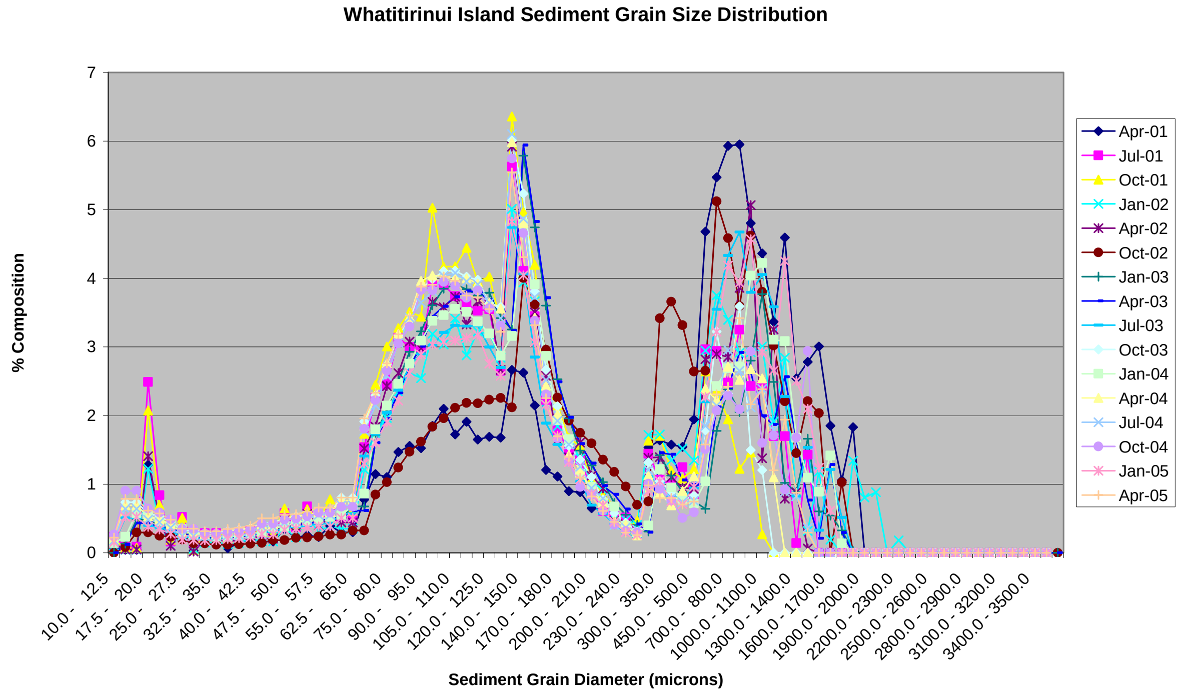


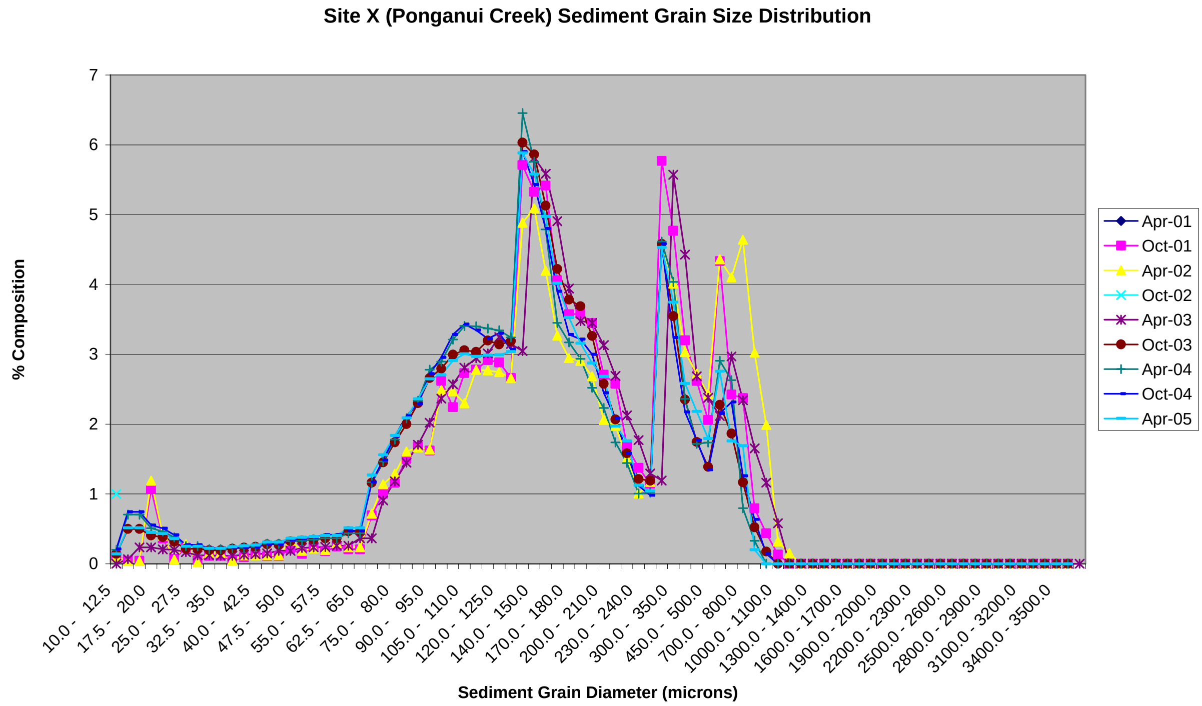
Okete Bay Sediment Grain Size Distribution



Te Puna (TU) Sediment Grain Size Distribution




Whatitirinui Island Sediment Grain Size Distribution
% Composition
Sediment Grain Diameter (microns)
Apr-01
Jul-01
Oct-01
Jan-02
Apr-02
Oct-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05


Site X (Ponganui Creek) Sediment Grain Size Distribution
% Composition
Sediment Grain Diameter (microns)
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05

Appendix 7 – QA/QC procedures

Each sample is sieved and preserved in the field, returned to the laboratory, and analysed for indicator species. All non-indicator species are classified into major taxonomic groups (amphipods, bivalves, crabs, cumaceans, gastropods, isopods, ostracods, polychaetes, shrimps and “other”) and enumerated. The laboratory analysis of samples for benthic communities involves two processes:

- Sample sorting.
- Species identification and enumeration.

A subsequent step is the input and storage of data into corporate databases. There are also quality control procedures in place for this step.

Quality control of sample sorting[10] is essential to ensure the value of all subsequent steps in the sample analysis process. Re-sorting of samples is employed for quality control of sorting. As a minimum re-sorting effort, a random selection of 16% (2 out of 12 samples) of the samples from each site is completely re-sorted. Re-sorting is conducted by an experienced sorter other than the original sorter.

Percent sorting efficiency is:

$$\frac{\text{\# organisms originally sorted}}{\text{\# organisms originally sorted + \# organisms found in re-sort}} \times 100$$

Minimum acceptable sorting efficiency is 95%. If sorting efficiency is greater than 95%, no action is required. Sorting efficiencies below 95% require re-sorting of all samples from the site concerned. Note that samples that are completely re-sorted after falling below 95% are assumed to have achieved 95% efficiency. Any organisms found in the re-sort should be added to the original sorted sample for later identification and enumeration. Once all quality control criteria for sample sorting have been met, the sample debris (shell-hash) can be dried and weighed.

The goal of species identification and enumeration is species or species group level identification and an accurate count of each indicator species, and identification and an accurate count of remaining taxonomic groups. Quality control is provided by complete re-identification and re-enumeration of a random selection of 16% of the samples from each site. This includes examination of any material left-over from each sorted sample. Re-identification and re-enumeration is conducted by an experienced identifier other than the original identifier.

Percent identification and enumeration efficiency is:

$$\frac{\text{\# organisms in re count – number of errors}}{\text{\# organisms in re count}} \times 100$$

Note that the number of errors is based upon the difference between the original (correctly identified) count and the re-count.

Minimum acceptable identification and enumeration efficiency is 90%. If identification and enumeration efficiency is greater than 90%, no action is required. Identification and enumeration efficiencies below 90% require that the type of error (see below) is identified and samples re-analysed for this error. Laboratory data sheets should be amended accordingly.

[10] Sorting is the separation of biological material from sediment, shell-hash, and other non-living biological material retained by a 500 µm sieve.

The following are examples of potential errors in species identification and enumeration:

- Counting errors (e.g., counting 11 individuals of a species/species group as 10 or 12; including dead bivalves in a count; including headless polychaete parts in a count).
- Identification errors (e.g., identifying species X as species Y).
- Unrecorded species errors (e.g., not identifying species X when it is present).
- Recording errors (e.g., recording species X as species Y on a data sheet).
- Specimens overlooked in the original analysis (e.g., missed organisms in the left-over sample).

A standard processing form is used for tracking each sample. It includes the details of each sample, the name of the sorter and identifier responsible, time required for sorting and species identification and enumeration, and any additional comments. These need to be completed at each stage of the laboratory analysis of all the samples.