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Central Waitemata Harbour Ecological Monitoring: 2000 - 2006

Jane Halliday
Judi Hewitt
Carolyn Lundquist

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National Institute of Water & Atmospheric Research Ltd
Gate 10, Silverdale Road, Hamilton
P O Box 11115, Hamilton, New Zealand
Phone +64-7-856 7026, Fax +64-7-856 0151
www.niwa.co.nz

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Reviewed by:

D.Lohrer

Approved for release by:

S. Thrush

Formatting checked

A. Bartley

1 Executive Summary

This report details the results of a State of the Environment monitoring programme for the Central Waitemata conducted between October 2000 and February 2006. The focus of the programme was to monitor the ecological status and trends of change in macrobenthic communities in the Central Waitemata. The design of the programme matches those carried out in Mahurangi and Manukau Harbours.

Five intertidal soft-sediment sites are located in sub-regions of the Central Waitemata, with the sub-regions defined by hydrodynamic regions and drainage areas with significant intertidal habitats. The sites integrate over as many anthropogenic inputs as possible, while being distanced from any industry-specific source. The monitoring focuses on 20 taxa which should respond differently to changes in site characteristics. This method has proved useful in monitoring Manukau and Mahurangi and has been further validated in work carried out by NIWA and the University of Auckland on ways of defining healthy communities (Anderson et al. 2002).

This report addresses several questions relevant to State of the Environment monitoring:

- Have the sedimentary habitats represented by the sites changed?
- Have any of the sites undergone changes in monitored species or in overall community structure?
- If there are any changes to the ecology, do they reflect changes in habitat conditions (e.g., sedimentation) or can they be attributed to some other factor (e.g., long-term natural cycles or chemical contamination)?
- Are changes confined to one site or one area of the harbour or do they reflect a harbour-wide change?

While some changes in sediment characteristics have occurred at the sites over the monitored period, these have not been large changes and have not resulted in changes to the communities observed at the sites.

A number of changes in abundance of the monitored taxa have been observed, but, similar to the Manukau, these are primarily seasonal and multiyear cycles in abundance. The trends in abundance that have been observed are not consistent with either increased sedimentation or contamination.

Four trends in abundance were observed which were representative of large areas of the harbour. The bivalve Nucula decreased in abundance at the two outer sites and the central site. The polychaete Aquilaspio decreased at the two inner sites and the central site. A gastropod decreased and an anemone increased at the two inner sites. These changes may, with more data, turn out to be long-term cycles in abundance. Again, based on what we know of the species sensitivities, the changes in abundance seem unlikely to be associated with either increased sedimentation or contamination. That the two sites most similar in community composition are located on the same large intertidal flat that stretches between the entry of the Henderson Creek and the Whau River suggests that recruitment and dispersal dynamics may be playing a role.

The maintenance of different communities and differing population dynamics at the different sites suggest that each site contributes to the strength of the ecological monitoring programme. This, together with the consistency of some changes observed between nearby sites, leads us to recommend that the monitoring programme be continued in its entirety. Furthermore, the monitoring programme is providing useful information for other ARC projects. HBV is utilized as part of the upper Waitemata Harbour environmental monitoring programme (EMP) to help determine whether changes as a result of urbanisation of the upper Waitemata Harbour spread in the central Waitemata Harbour. Three of these sites help provide the definition of health for the Regional Discharges monitoring programme; in particular they provide information on how much effect variations in recruitment may have on the health model and the time series changes in community structure can be analysised to provide information on the relative importance of changes in bioturbators for the Central Waitemata modeling programme.

Further changes at Reef site may occur, associated with seagrass growth at the site. Based on past observations provided by the Manukau EMP seagrass growth in the Auckland region occurs in long-term cycles of expansion followed by contraction. Although the previous observations found no effect of the seagrass on community structure, we recommend, if seagrass growth continues, that samples taken in and out of seagrass are processed separately, and measurements are made of the area of the site covered by seagrass.

2 Introduction

2.1 Background

In October 2000, a State of the Environment monitoring programme for the Central Waitemata was developed for the Auckland Regional Council (ARC). The programme was designed to be scientifically credible, practical, affordable and to meet the requirements of the Resource Management Act (1991). The focus of the programme was to monitor the ecological status and trends of change in macrobenthic communities in the Central Waitemata. The design of the programme matched that carried out in Mahurangi and Manukau Harbours.

Hewitt (2000) suggested that the Central Waitemata would be best represented by 6 intertidal sites, 5 soft sediment and one rocky habitat. In 2000, NIWA was commissioned to monitor the soft sediments and the University of Auckland was to monitor the rocky site. The soft-sediment sites were selected for monitoring in consultation with the ARC, and were chosen to integrate over as many aquatic inputs as possible, while being distanced from any industry-specific source. A site was placed in each of five sub-regions of the Central Waitemata, based on hydrodynamics and drainage areas with significant intertidal habitats (Figure 1; Hewitt, 2000). Details on site selection are given in the first report (Nicholls et al. 2002).

The monitoring focuses on a selection of species (see Nicholls et al. 2002) that could be expected to respond to changes in their surroundings in a variety of ways. This method has proved useful in monitoring Manukau and Mahurangi and has been further validated in work carried out by NIWA and the University of Auckland on ways of defining healthy communities (Anderson et al. 2002).

2.2 Risk context

Two of the most likely sources of anthropogenic effects on the Central Waitemata are increased sedimentation associated with urban development and contaminants associated with urban development and ongoing storm-water discharges. A less likely, but possible scenario, is the introduction of an invasive species displacing the natural communities.

2.2.1 Sedimentation effects.

To date there is little information available on sediment accumulation rates in the harbour, except for two sites (one intertidal, one subtidal) sampled near the Henderson Creek area in muddy sediments. However most of the catchments surrounding the central harbour are fully urbanised, therefore sedimentation rates are likely to be relatively low. A considerable amount is known of effects of increased sedimentation and suspended sediment concentrations on species abundances, both through NIWA

(FRST-funded) and ARC data. This body of work has been summarized in Gibbs et al (2004). The results for the monitored taxa are listed in Appendix 1.

2.2.2 Contaminant effects

The potential for pollution associated with storm-water inputs to the Central Waitemata is of serious concern to the ARC. A number of projects have investigated this potential (Williamson and Kelly 2003, Green et al. 2004, Kelly 2004, Reed and Webster 2004, Williamson 2004) and the ARC has developed a Regional Discharges monitoring Project (RDP). There are three parts to this project. (1) Monitoring of sediment concentrations of copper, zinc and lead at at 2-5 year intervals depending on contaminant concentrations. Ecology is also monitoring where contaminant concentrations are above threshold effects levels (TEL's). (2) Monitoring of benthic invertebrate communities at intervals triggered by the sediment chemistry sampling. (3) Building of a multivariate model of ecological health based on benthic invertebrate data collected from a number of sites throughout the Auckland Region (Anderson et al. 2002). In this model, the ecological community found at a site can be measured against the natural variability observed in healthy and impacted sites and allotted a health index. Some of the Central Waitemata Ecological monitoring sites provide information to this project; HBV, HC and Whau are all part of the model data, helping to form the definition of health. This model is still being refined to remove potential effects of sediment particle size and wave exposure.

No information is presently available on the sensitivity of the monitored taxa to most contaminants. However, in two FRST funded programmes, species abundance and chemical data collected by both NIWA and the ARC are being analysed. In one case this is to assess the degree to which species in coastal and estuarine waters are responding to multiple, rather than single, stressors. In the other, the focus is on determining methods to measure health, including indicator species. In both these projects, the relationships between the abundance of a number of species (including many of the monitored taxa) and concentrations of copper, zinc and lead in the < 63um sediment fraction are being assessed using quantile regressions. Quantile regressions investigate all responses to a stressor, rather than concentrating on a mean response. They are, therefore, very effective for situations where a number of factors operate within a constraining factor. A common phenomenon in ecology is for data points in scatter plots of species-environment data to be widely scattered beneath an upper (or above a lower) limit – a phenomenon described by Thomson et al. (1996) as a "factor ceiling". Quantile regressions based on 90th percentiles enable us to estimate the factor ceiling.

This analysis has shown that the majority of monitored species are sensitive to copper, zinc and lead, in the < 63um sediment fraction, at levels below the ERL guidelines (Appendix 2).

2.2.3 Invasive species

A number of invasive species have been recorded in the Waitemata (see Appendix 3). Of these 4 species were definitely found: *Musculista senhousia*; *Theora lubrica*;

Chaetopterus sp. A and *Pseudopolydora corniculata*. *Musculista* and *Pseudopolydora* are the most frequently found. *Musculista* has been found at all sites but only occasionally as a few isolated individuals, except in the Whau in April 05 when around 50 individuals were found scattered around the site. *Pseudopolydora* is found in low numbers on various occasions at Reef and ShB.

Two introduced Corophid amphipod species (*Monocorophium acherusicum* & *M. sextonae*) not previously recorded from the Waitemata were observed infrequently, in low numbers, at all sites in the first three years. However, the dominant Corophid amphipod at all sites was the native *Paracorophium excavatum*. On one occasion at a single site a couple of brozoans and serpulid worms specimens were found. Due to their scarcity these were not identified to a lower level thus it is not possible to determine whether they were invasives. Generally, the lack of temporal consistency or increasing densities recorded for the invasive species suggest they are unlikely to pose a problem.

2.3 Report focus

This report presents the results from monitoring the soft-sediment sites between October 2000 – February 2006 and details the present status of the benthic communities of the Central Waitemata. In particular the following questions are addressed:

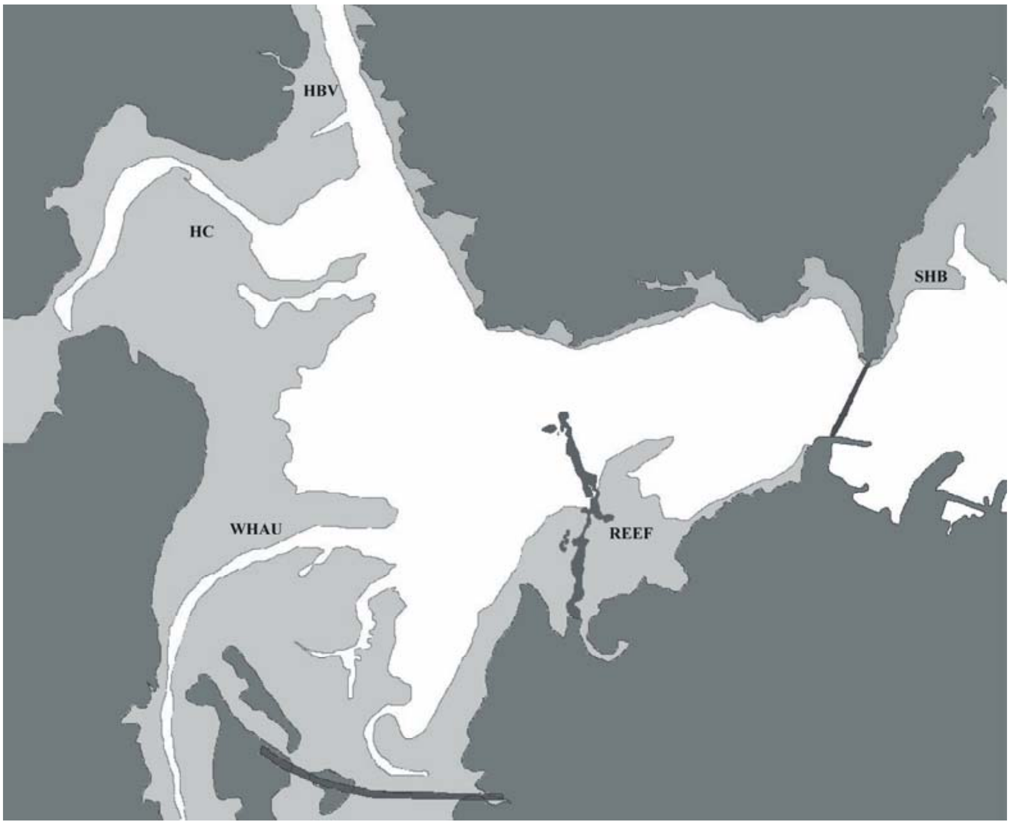
- Have the sedimentary habitats represented by the sites changed?
- Have any of the sites undergone changes in monitored species or in overall community structure?
- If there are any changes to the ecology do they reflect changes in habitat conditions (e.g., sedimentation) or can they be attributed to some other factor (e.g., long-term natural cycles or chemical contamination)?
- Are changes confined to one site or one area of the harbour or do they reflect a harbour-wide change?

In the design of the monitoring strategy for the ARC, Hewitt (2000) recommended that after 5 years consideration should be given to whether the number of samples taken at a site, the number of visits per year, or the number of sites should be decreased. To keep consistency between the monitoring programmes, the ARC has decided to keep the number of samples taken at a site at 12. Comparison between the Manukau and the Mahurangi Ecological Monitoring Programmes emphasised the value gained by sampling 6 times per year, rather than 4 (Hewitt 2000). This leaves only dropping sites as an alternative. However, at this point in time the ARC would prefer to leave this question aside. Thus the design of the monitoring programme will not be discussed in this report.

The report also provides information on invasive species found in the harbour and bioturbation information useful for the Central Waitemata modeling programme.

Figure 1:

Map of Waitemata Harbour showing the five permanent soft-sediment monitoring sites at Hobsonville (HBV), Henderson Creek (HC), Whau River (Whau), Te Tokaroa Reef (Reef) and Shoal Bay (ShB).



3 Methods

Five soft-sediment sites are sampled representing five different sub-regions of the Central Waitemata: Upper-Waitemata-Hobsonville (HBV); Henderson Creek (HC); Whau River (Whau); Meola Creek, Motions Creek and Te Tokaroa Reef area (Reef); and Shoal Bay (ShB) (see Figure 1). All sites are located at mid-tide level and each cover an area of 9000 m^2.

Sites are located in areas that are representative of the general character of the surrounding intertidal area and are as close to channels as practical (to aid access). Sites are marked by wooden stakes and located by GPS (Table 1).

Table 1:

Dimensions and GPS co-ordinates for the monitored sites in the Central Waitemata. Hobsonville (HBV), Henderson Creek (HC), Whau River (Whau), Te Tokaroa Reef (Reef), Shoal Bay (ShB).

Site	Dimensions (m)		GPS coordinates in NZMG	
	X	Y	North	East
HBV	180	60	6487791	2660090
HC	100	90	6486226	2658567
Whau	100	90	6482500	2659244
Reef	180	50	6482597	2663505
ShB	180	50	6485554	2667087

Methods and techniques used for sampling and sample processing are consistent with those used at the established sentinel locations of Mahurangi and Manukau Harbours, and have been detailed in a previous report (Nicholls et al. 2002). Sampling is conducted every 2 months, and began in October 2000. The methods used are briefly described below.

3.1 Macrofauna

On each sampling occasion, 12 core samples (each 13 cm diameter, 15 cm deep) are collected from each site. To provide an adequate spread of cores over the site, a site is 'divided' into 12 equal sections and one core sample is taken from a random location within each section. To reduce the influence of previous sampling activity and spatial autocorrelation, samples are not placed within a 5 m radius of each other or of any samples collected in the previous 12 months. Core samples are sieved through a 500 µm mesh and the residues stained with rose bengal and preserved in 70 % isopropyl alcohol in seawater. Samples are then sorted and stored in 50 % isopropyl alcohol. The 20 selected species (see Table 2) are counted and stored in 50 % isopropyl alcohol. Other macrofauna are identified to the family level, where possible, and counted. These other macrofauna are not discarded, rather they are processed under other funding at least once per year.

Table 2:

List of twenty taxa recommended for ongoing monitoring in the Waitemata Harbour long-term monitoring programme. As many genera and species change names with taxonomic reviews, names in brackets indicate alternatives.

Order	Taxa	Currently monitored	
		Manukau	Mahurangi
Bivalvia	*Arthritica bifurca*	✓	✓
	Austrovenus (Chione) stutchburyi	✓	✓
	Macomona (Tellina) liliana	✓	✓
	Nucula hartvigiana	✓	✓
	Paphies australis	X	X
Cnidaria	*Anthopleura aureoradiata*	✓	X
Cumacea	*Colurostylis lemurum*	✓	X
Gastropoda	*Diloma subrostrata*	X	X
	Haminoea zelandiae	X	X
	Notoacmea helmsi	✓	✓
	Zeacumantus lutulentus	X	X
Isopoda	*Exosphaeroma spp.*	✓	X
Polychaeta	*Aonides oxycephala (trifida)*	✓	✓
	Aquilaspio (Prionospio) aucklandica	✓	✓
	Aricidea sp.	✓	✓
	Boccardia syrtis	✓	X
	Euchone sp.	X	X
	Glycera sp.	X	X
	Heteromastus filiformis	X	✓
	Macroclymenella stewartensis	✓	X

3.2 Bivalve size class analysis

After identification, individual *Paphies australis*, *Austrovenus stutchburyi* and *Macomona liliana* are measured and placed into size classes (<1 mm, 1 – 5 mm, 5 – 10 mm, then 10 mm increments). Unlike the Manukau and Mahurangi monitoring programmes, not all bivalve species are measured as the high densities of *Nucula hartvigiana* found at some sites would make this uneconomic. Instead only those species which grow to be relatively large, and for which we know that juveniles are more sensitive to stress than adults, are measured.

3.3 Site characteristics

During each site visit, attention is paid to the appearance of the site and the surrounding sandflat. In particular, surface sediment characteristics and the presence of birds, gastropods and plants are noted.

3.4 Sediment characteristics

Sediment characteristics (i.e., grain size, organic content and chlorophyll *a*) are also assessed at each site on each sampling occasion. At six random locations within the site, two small sediment cores (2 cm deep, 2 cm diameter) are collected, one to determine grain size and organic content and the other for chlorophyll *a* analysis. The six cores are pooled, and kept frozen in the dark prior to being analysed as described below.

Grain size: The samples are homogenised and a subsample of approximately 5 g of sediment taken, and digested in ~ 9% hydrogen peroxide until frothing ceases. The sediment sample is then wet sieved through 2000 μm, 500 μm, 250 μm and 63 μm mesh sieves. Pipette analysis is used to separate the <63 μm fraction into >3.9 μm and ≤3.9 μm. All fractions are then dried at 60°C until a constant weight is achieved (fractions are weighed at ~ 40 h and then again at 48 h). The results of the analysis are presented as percentage weight of gravel/shell hash (>2000 μm), coarse sand (500 – 2000 μm), medium sand (250 – 500 μm), fine sand (62.5 – 500 μm), silt (3.9 – 62.5 μm) and clay (≤3.9 μm). Mud content is calculated as the sum of the silt and clay content.

Chlorophyll *a*: Within 1 month of sampling, the full sample is freeze dried, weighed, then homogenised and a subsample (~0.5 g) taken for analysis. Chlorophyll *a* is extracted by boiling the sediment in 90% ethanol, and the extract processed using a spectrophotometer. An acidification step is used to separate degradation products from chlorophyll *a*.

Organic content: Approximately 5 g of sediment is placed in a dry, pre-weighed tray. The sample is then dried at 60°C until a constant weight is achieved (the sample is weighed after ~ 40 h and then again after 48 h). The sample is then ashed for 5.5 h at 400°C (Mook and Hoskin 1982) and then reweighed.

3.5 Statistical analyses

When the State of the Environment monitoring programme was developed for the ARC, the methods to be used in analysing the data were also detailed (Hewitt, 2000). This report recommended that, every 2 years, a graphical analysis of patterns in selected taxa abundances over time at each site should be conducted to identify seasonal patterns, multiyear patterns and trends.

A number of other analyses were conducted:

- The presence of autocorrelation was assessed using plots of partial and inverse autocorrelation coefficients against lags and tests for white noise.

- Trends over time were assessed using regression techniques adjusted for autocorrelation where necessary. Non-linear trends were assessed using transformations (for logarithmic or exponential functions), 2 degree polynomials, splines or by t-tests (step trends).
- Changes in dominant taxa over time were investigated to determine whether observed changes in individual monitored taxa led to community changes.
- Overall changes in sediment characteristics were assessed using multivariate ordinations. A Principle Component Analysis, based on normalized Euclidean distances, was done on all sites and times. After examining the overall plot for seasonal differences, only October samples are presented in the figure 3 in the report.
- Multivariate ordination of ecological data collected in October of each year was used to determine whether community composition at the sites was changing over the monitored period. Ordination of raw, log transformed and presence/absence data were conducted, using both correspondence analysis and nonmetric multidimensional scaling based on Bray Curtis similarities. Only the nonmetric multidimensional scaling ordination is presented in this report, as both types show similar interpretations.
- Population dynamics were compared between sites using time series analysis of cross lag correlations.
- For taxa exhibiting trends at more than one site, the potential for large-scale climatic events to affect population dynamics was assessed using time series models that included the Southern Oscillation Index and air temperature statistics as dynamic correlates.

Note that all analyses conducted are performed on the sum of the 12 cores collected at a site.

4 Present status of the benthic communities of Central Waitemata[1]

This programme was designed to monitor the ecological status and trends of change in macrobenthic communities in the Central Waitemata. An important process in detecting trends is determining temporal variability, as knowledge of cyclic patterns of recruitment aids in detection of long-term trends (Hewitt et al. 1994). Thus, in this report we ask the following questions:

- Have there been any changes in site characteristics?
- At each site, are species exhibiting temporal variations that appear predictable, i.e., trends, seasonal patterns or multiyear cycles?
- Are species' abundances exhibiting similar patterns at each site?
- Have any changes in species over time led to changes in communities, with sites becoming more or less similar to each other?

4.1 Have there been any changes in site characteristics?

4.1.1 Hobsonville (HBV) Plate 1

Site HBV is located on the sandflats near the Hobsonville Air Base, close to the deep channel entering the Upper Waitemata Harbour. The sandflat at HBV exhibits many of the characteristics of areas subject to high flow (coarse sediment, ripples in the sediment surface). Large fragments of old logs are often found buried below the sediment surface, and there is a thick shell layer approximately 15 cm below the surface. While the site itself has changed little since monitoring began, a small channel on the seaward/eastern side appears to be increasing in muddiness, as does the edge of the main channel.

Sediment at HBV is predominantly medium and fine sand, with a small amount of coarse sand (Table 3). The proportion of mud and fine sand was highest during the first 18 months sampling. This change in sediment characteristics can also be noted on the Principle Component Analysis (PCA) plot of sediment characteristics over time (Fig. 3). Since then no change in sediment characteristics have been noted. Chlorophyll *a* content of the sediments ranged between 8 and 17.5 µg/g sediment, while the organic content is low and variable.

[1] Summary statistics of the monitored populations are presented in Appendix 5.

Table 3:

Summary of sediment characteristics at Hobsonville (HBV), Henderson Creek (HC), Whau River (Whau), Te Tokaroa Reef (Reef), Shoal Bay (ShB), from October 2000 to October 2005. Chla = chlorophyll *a* in µg.g^{-}, coarse sand (500 – 2000 µm), medium sand (250 – 500 µm), fine sand (62.5 – 500 µm), mud (< 62.5 µm). Full results are given in Appendix 4.

site	date	%mud	%fine sand	%medium	%coarse	%organics	chla
HBV	Oct-00	8.13	74.16	12.20	4.01	0.95	10.26
	Oct-01	5.32	73.67	14.90	4.02	0.81	16.50
	Oct-02	1.99	54.79	31.31	8.15	3.73	13.98
	Oct-03	1.55	50.07	39.00	7.84	0.78	7.97
	Oct-04	2.95	52.05	25.78	5.87	1.75	10.78
	Oct-05	2.12	54.51	36.31	6.86	1.53	17.55
	mean	3.68	59.88	26.59	6.12	1.59	12.84
HC	Oct-00	4.00	55.08	23.92	9.36	1.61	9.53
	Oct-01	2.30	58.56	30.63	7.43	1.46	21.67
	Oct-02	6.39	75.07	13.30	3.24	2.04	22.49
	Oct-03	6.26	77.57	12.42	2.70	1.90	20.34
	Oct-04	7.39	71.92	17.67	3.03	2.85	19.92
	Oct-05	9.47	77.16	10.86	2.01	2.24	18.41
	mean	5.97	69.23	18.13	4.63	2.02	18.73
Whau	Oct-00	2.77	93.64	1.79	0.80	0.76	5.23
	Oct-01	2.75	92.42	2.78	0.47	0.86	10.72
	Oct-02	3.30	91.71	3.79	0.56	0.75	7.79
	Oct-03	2.92	93.55	2.24	0.66	0.92	6.87
	Oct-04	2.06	93.08	1.07	0.39	1.17	11.22
	Oct-05	3.15	92.89	1.40	0.90	1.01	12.41
	Mean	2.82	92.88	2.18	0.63	0.91	9.04
Reef	Oct-00	4.09	91.80	3.77	0.28	0.90	7.28
	Oct-01	3.43	89.44	5.21	0.26	0.74	10.54
	Oct-02	5.08	92.25	1.67	0.11	1.04	10.46
	Oct-03	6.74	90.29	2.59	0.27	1.08	6.42
	Oct-04	6.47	91.82	1.67	0.04	1.20	5.36
	Oct-05	7.61	90.31	1.90	0.11	1.64	18.45
	Mean	5.57	90.99	2.80	0.18	1.10	9.75
ShB	Oct-00	3.46	78.71	14.11	2.46	0.63	5.23
	Oct-01	13.01	63.30	22.43	0.70	0.48	10.72
	Oct-02	3.06	80.84	11.70	3.33	0.81	7.79
	Oct-03	3.25	79.66	12.31	2.13	0.70	6.87
	Oct-04	1.67	72.67	24.18	0.77	0.87	8.37
	Oct-05	4.83	84.69	8.11	0.87	1.01	14.32
	Mean	4.88	76.65	15.47	1.71	0.75	8.89

4.1.2 Henderson Creek (HC) Plate 2

Site HC is located adjacent to Henderson Creek on a large intertidal flat, which is fringed by mangroves on the upper edge and supports patches of Pacific oysters. The sediment is generally free of surface features such as ripples. HC sediments are predominantly medium and fine sand (Table 3). This change in sediment composition can also be noted as a change on the PCA plot of this site (Fig. 3). The proportion of mud and fine sand has increased at this site over the six years of monitoring (Table 3). Chlorophyll *a* content is generally high, ranging from 9 – 38 µg/g sediment, with a cyclic pattern of lowest chlorophyll content observed in October. Organic content is low and variable.

4.1.3 Whau River (Whau) Plate 3

Site Whau is located on the north-western side of the Whau River. The flats here are large, sandy and they generally show signs of wind-wave activity (small ripples on the sediment surface). No changes have been noted at the site or the nearby channel. Sediment from Whau is predominantly fine sand (Table 3), with average chlorophyll *a* content (generally <10 µg/g) and very low organic content (generally < 1 %).

4.1.4 Te Tokaroa Reef (Reef) Plate 4

The intertidal flat on the eastern side of Te Tokoroa Reef is a muddy sandflat with a small channel dissecting it. Of all the areas, this has the longest uninterrupted fetch, and the presence of the reef may make for wave and current interactions. The site itself is situated next to scattered patches of rock, well away from the channel, with high numbers of gastropods. A diatomaceous film often covers the site and *Ulva* has been observed on intertidal areas towards the channel on occasions. Since December 2004 patches of seagrass (*Zostera capricorni*) have established at the site (Plate 4). The number and size of these patches has slowly increased over time. Based on past observations of the Manukau ecological monitoring programme seagrass growth in the Auckland region occurs in long-term cycles of expansion followed by contraction. The expansion of the seagrass cover at Reef is also occurring at Snells Beach and in the Kaipara Harbour (according to people living in the area) and in Whangapoua Harbour (NIWA observations).

Sediment at Reef is also dominated by fine sand (87 – 95%); but this site exhibits the lowest proportion of coarse sand (< 1%) of all the monitored sites (Table 3). The chlorophyll *a* and organic content of the sediment are moderate to low.

4.1.5 Shoal Bay (ShB) Plate 5

The intertidal flat selected for monitoring in Shoal Bay is adjacent to the Auckland Harbour Bridge, and near a large rock platform. The sediment in the area is coarse with ripples on the sediment surface - both characteristics of an exposed site. A buried pipeline running perpendicular to the shore intersects the site. Broken bottles, discarded tires and plastic are often observed on this sandflat.

Sediment at ShB is mainly fine sand, although a considerable proportion of medium sand is found (mean 15.5%, Table 3). ShB sediments have the lowest mean organic content (0.23 – 1.94%) of all the monitored sites, and chlorophyll *a* is frequently low.

4.1.6 Summary of site characteristics

Table 4:

Analysis of temporal variability in sediment characteristics at five sites from October 2000 to February 2005; Hobsonville (HBV), Henderson Creek (HC), Whau River (Whau), Te Tokaroa Reef (Reef) and Shoal Bay (ShB): Average annual variability (SD) of sediment % by weight, coarse sand (500 – 2000 μm), medium sand (250 – 500 μm), fine sand (62.5 – 500 μm), mud (< 62.5 μm) and Chla = chlorophyll *a*. Note: gravel faction (>2000 μm) not included.

site	%mud	%fine sand	%medium sand	%coarse sand	%organics	chla $\mu g.g^{-1}$
HBV	1.18	5.92	6.27	1.70	1.01	3.00
HC	1.20	7.40	6.86	1.49	0.63	5.29
Whau	1.73	2.49	1.38	0.16	0.83	2.51
Reef	1.86	6.82	6.33	1.52	0.26	1.79
ShB	0.82	2.33	1.70	0.18	0.38	1.82

Values for organic content and chlorophyll a remain comparable to the other sentinel sites in the Manukau and Mahurangi Harbours (Funnell et al. 2005, Cummings et al. 2005). As commented on in the previous report, mean chlorophyll *a* varied among sites, with highest values at HC and lowest at ShB and Whau (Table 3). Organic content was low at all sites (i.e., <3%) and, similar to chlorophyll a, was lowest at ShB (Table 3).

The sites can be split into two groups on the basis of within-year variability in sediment characteristics: Whau, ShB and Reef have lower variability than HBV and HC (Table 4). Few consistent seasonal fluctuations were observed except for chlorophyll *a* (at HBV and HC) and organic content (at all sites). Organic content also exhibited multiyear cycles. After 3.5 yrs, sites HBV and HC showed signs of progressive change in grain size, with %mud decreasing at HBV and increasing at HC. This change has not continued, although HC has become increasingly variable (Fig. 2 & 3). Occasionally high percentage mud values were recorded for a site, for example ShB October 2001 (see Table 3). These are likely to be caused by localised storm events.

Figure 2:

Percent mud content decreased at HBV after 1-5 years and increased at HC over 3 years. Temporal variability at HC has increased.

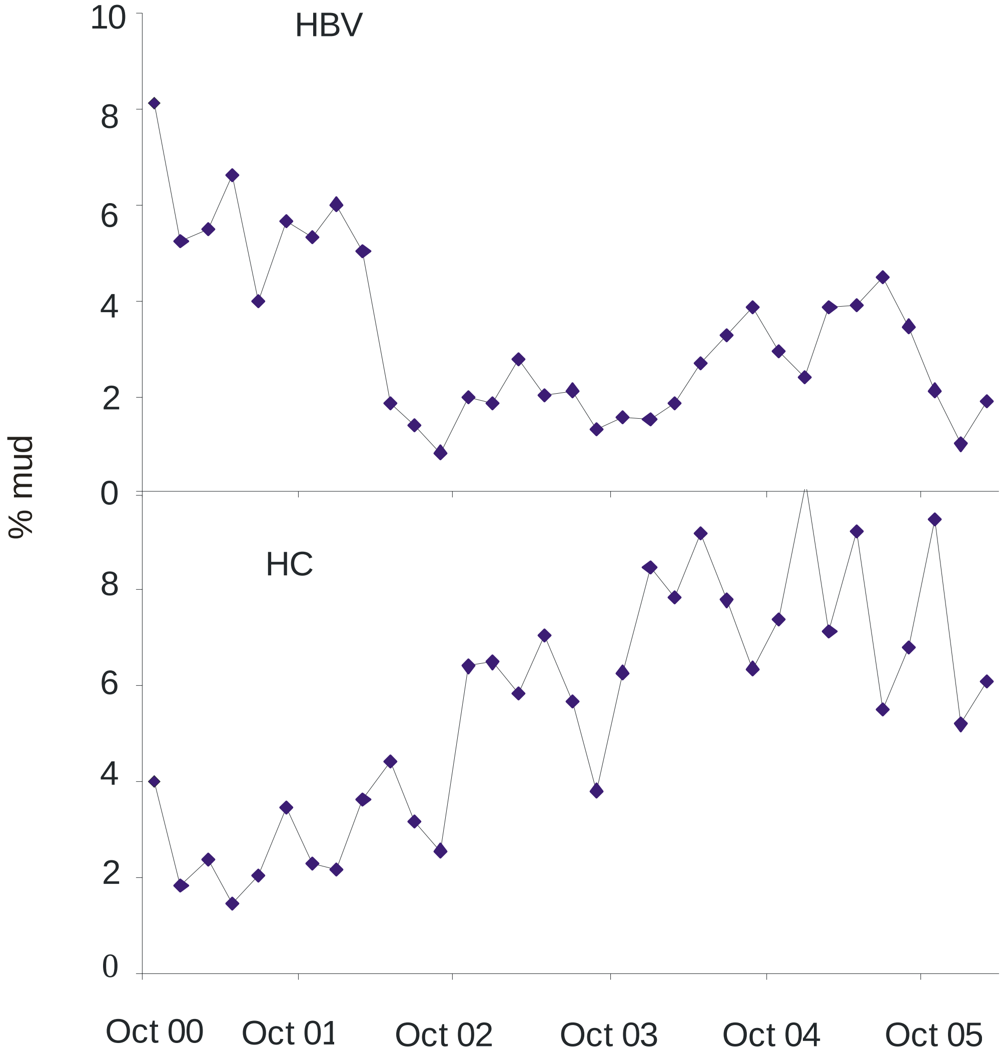
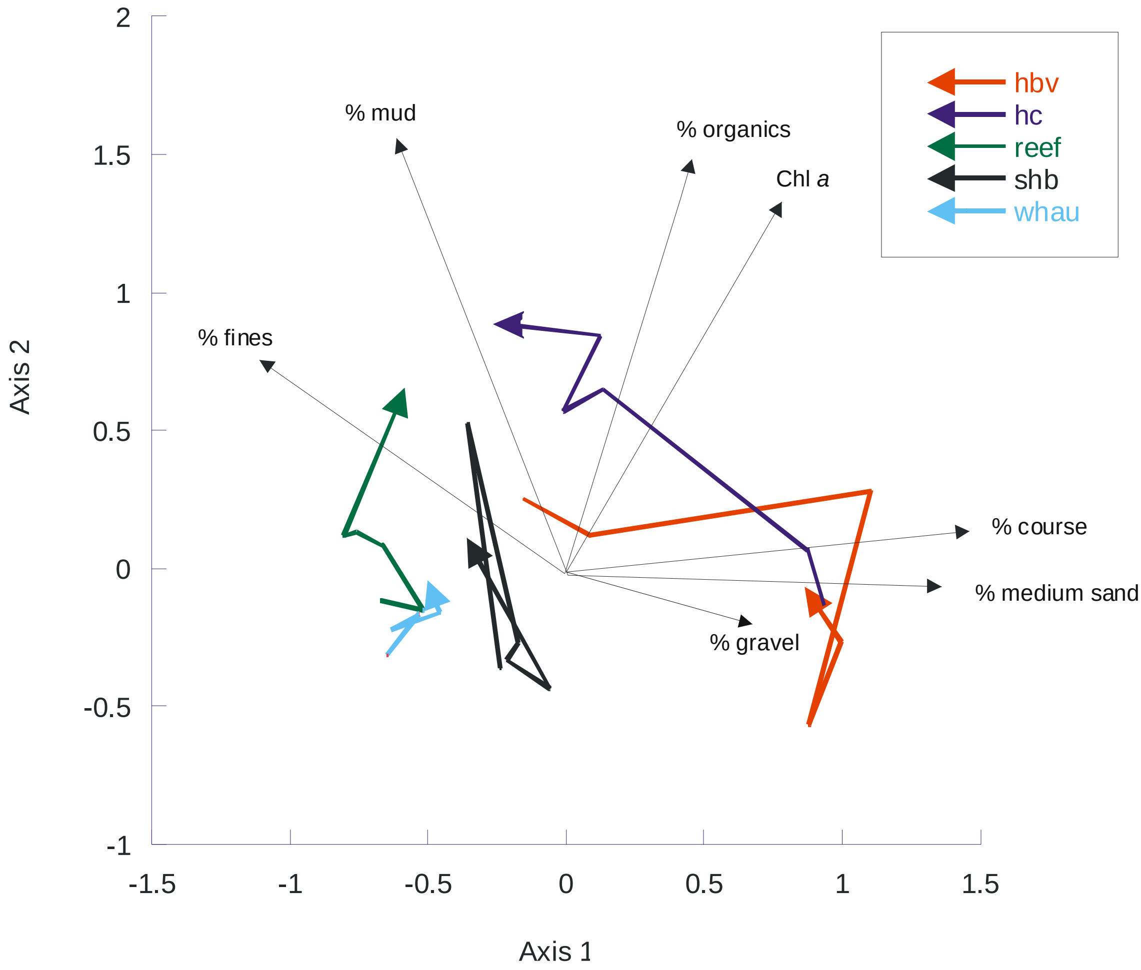


Figure 3:
Principle components analysis of site sediment properties, plotted in two dimentional space, showing changes over time at the sites. Superimposed on the plot are the sediment characteristics. The position of the sediment characteristics relative to the sites show which characteristics dominate the sites.



4.2 At each site, are species exhibiting temporal variations that appear predictable?

This section describes patterns observed in species abundances at a site. Three types of patterns are described: trends, seasonal patterns that are similar in timing from year to year; and multiyear patterns. The latter are usually variations in the magnitude of seasonal recruitment, although the description also covers species that have multiyear recruitment patterns.

4.2.1 Hobsonville (HBV)

Table 5:

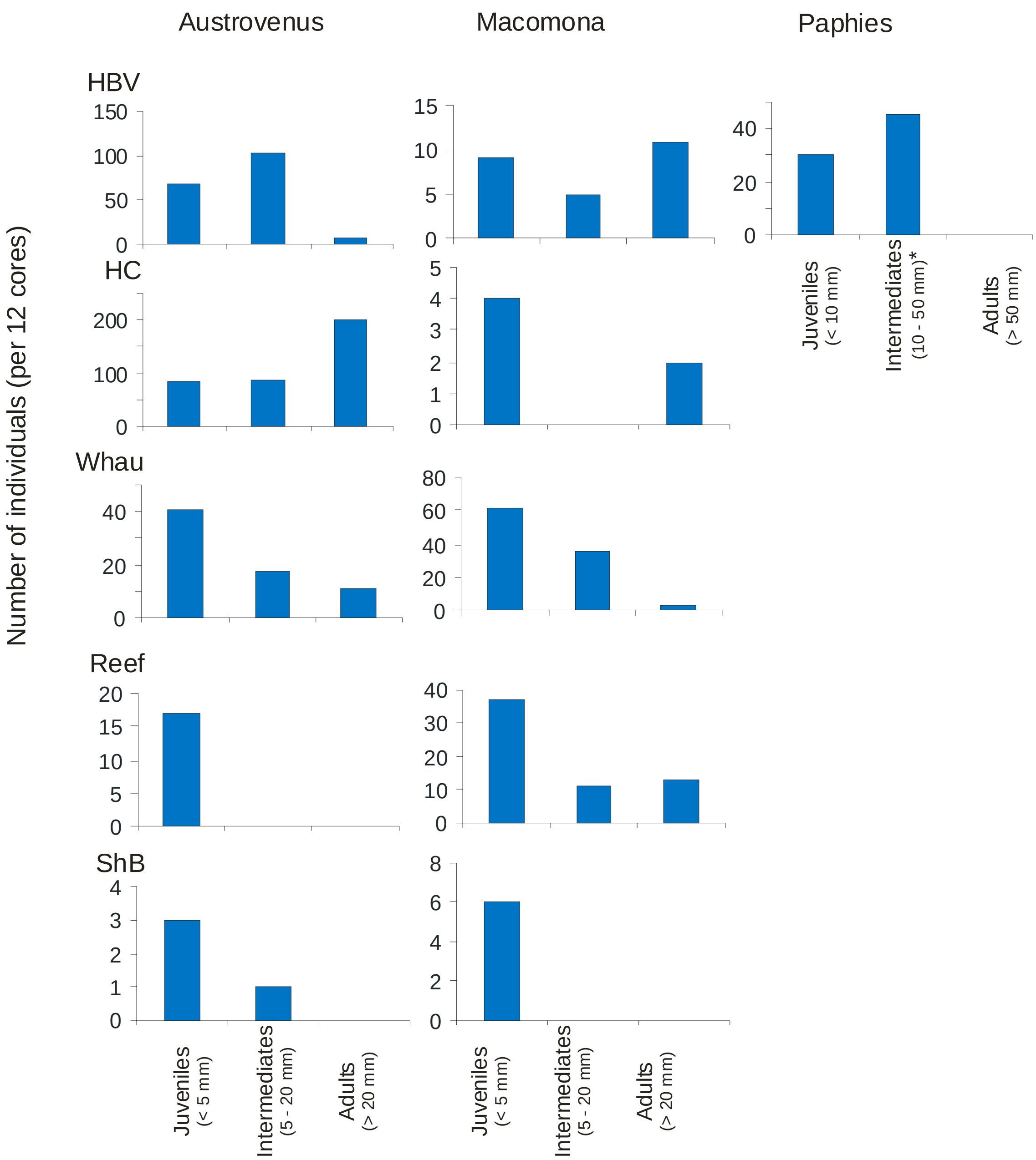
The three most abundant monitored taxa found over time at HBV.

Date	Most abundant	⇨	Least abundant
Oct-00	*Nucula*	*Aonides*	*Austrovenus*
Oct-01	*Nucula*	*Aonides*	*Austrovenus*
Oct-02	*Nucula*	*Aonides*	*Austrovenus*
Oct-03	*Nucula*	*Aonides*	*Austrovenus*
Oct-04	*Nucula*	*Aonides*	*Austrovenus*
Oct-05	*Nucula*	*Aonides*	*Notoacmea*

The site was dominated by a few, reasonably abundant taxa, with abundances of other taxa remaining fairly low (< 2 per core). The small deposit-feeding bivalve *Nucula hartvigiana* was by far the most abundant species at HBV throughout the sampling period (Table 5). The polychaete *Aonides oxycephala* and the cockle *Austrovenus stutchburyi* were also consistently abundant. The limpet *Notoacmea helmsi*, the polychaete *Aquilaspio aucklandica* and the pipi *Paphies australis* were generally amongst the five most dominant taxa. This site was the only site at which *Paphies* were consistently found, although the population was predominantly juveniles <10 mm (Fig 4), as adults prefer to live further down the shore. Limited numbers of adult *Austrovenus* occurred at HBV. Conversely, adult *Macomona liliana* were relatively abundant, with numbers similar to HC and Reef. Unlike *Paphies*, adult *Austrovenus* and *Macomona* are found at a wide range of tidal heights, although larger adult *Asutrovenus* are often found on the edges of channel banks (Hewitt pers. comm.) and juvenile *Macomona* have been recorded moving down shore as they increase in size (Hewitt et al. 1997), suggesting some habitat-size preferences. The abundant juvenile *Austrovenus* found at this site may, therefore, either be produced onsite and nearby channel banks or further away in the harbour.

Figure 4:

Size class distributions of cockles *(Austrovenus stutchburyi),* wedge shells (*Macomona liliana*) and pipis (*Paphies australis*) in 3 distinctive size categories, measured as maximum shell width, at each site in June 2005. Population structures during recruitment periods are generally dominated by juveniles. To give a more general representation of population structure, this graph is based on June, typically a month when juvenile recruitment is low or absent. * = no *Paphies* >40 mm were found at this site.



Six species exhibited clear seasonal cycles (Table 6), *Aricidea*, *Boccardia*, *Aonides, Exosphaeroma, Anthopleura* and *Colurostylis lemurum*. All were most abundant in spring/summer. For the anemone, *Anthopleura*, these seasonal fluctuations overlay a steadily increasing trend in abundance. In contrast, the polychaete *Aquilaspio* has steadily decreased since 2001. Numbers of the mud snail, *Zeacumantus*, have increased from very low levels over the past two years. *Notoacmea* and *Exosphaeroma* both exhibited multiyear cycles in abundance but no directional trend (Fig. 5). Similarly, the bivalves, *Paphies*, *Macomona*, and *Nucula*, all displayed highly variable patterns of abundance, but no periodicity or directional trends.

Table 6:

Summary of temporal patterns in abundance of selected taxa observed at each site between October 2000 to February 2006. Hobsonville (HBV), Henderson Creek (HC), Whau River (Whau), Te Tokaroa Reef (Reef) and Shoal Bay (ShB).

	Seasonal cycles	**Multiyear patterns**	**Trends[2]**	**Trend direction**
HBV	*Arcidea* *Boccardia* *Aonides* *Exosphaeroma* *Anthopleura* *Colurostylis*	*Notoacmea* *Exosphaeroma* *Colurostylis*	*Anthopleura* *Zeacumantus* *Aquilaspio*	Increasing increasing decreasing
HC	*Aricidea* *Anthopleura* *Notoacmea* *Exosphaeroma* *Macroclymenella*	*Austrovenus* *Anthopleura* *Nucula* *Notoacmea* *Diloma*	Boccardia *Aquilaspio* *Zeacumantus* *Anthopleura*	decreasing decreasing increasing increasing
Whau	*Austrovenus* *Boccardia*	*Boccardia*	*Nucula* *Aricidea* *Aquilaspio* *Anthopleura* *Notoacmea* *Macomona*	decreasing decreasing decreasing decreasing (recient) decreasing (recient) increasing
Reef	*Austrovenus* *Arthritica* *Haminoea*	*Austrovenus* *Euchone* *Haminoea* *Macroclymenella*	*Nucula* *Hetromastus*	decreasing increasing
ShB	*Austrovenus* *Aonidies* *Nucula* *Notoacmea*	*Aricidea* *Anthopleura* *Colurostylis* *Euchone*	*Nucula* *Heteromastus* *Aquilaspio*	decreasing increasing Increasing

[2] Trends are statistically significant ($p < 0.05$) and identified using linear and non-linear methods

Figure 5:

Abundances of *Anthopleura* and *Zeacumantus* at HBV exhibit an increasing trend, while *Aquilaspio* exhibits a decreasing trend in abundance. *Colurostylis* is an example of a species exhibiting seasonal cycles and multiyear cycles in abundance

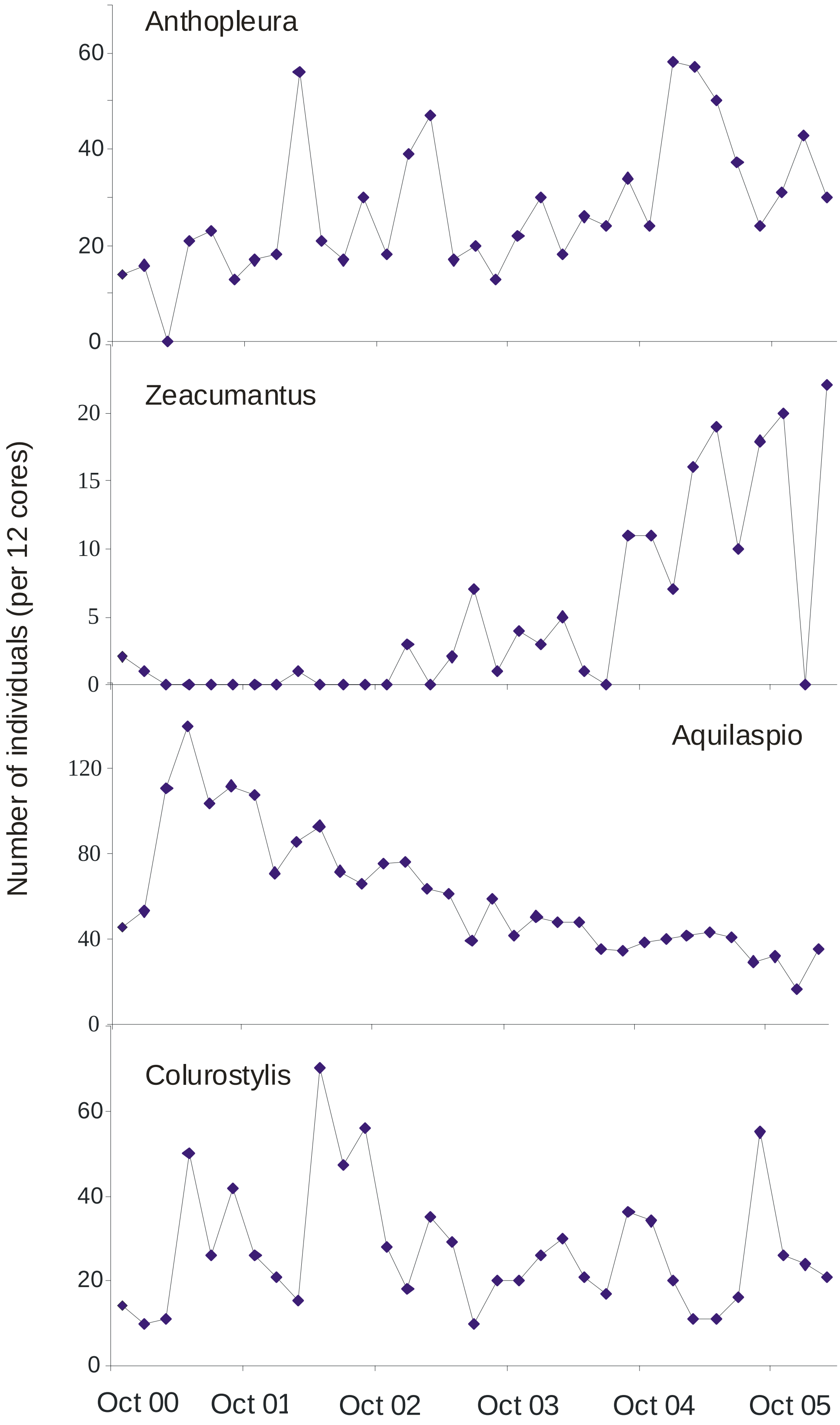
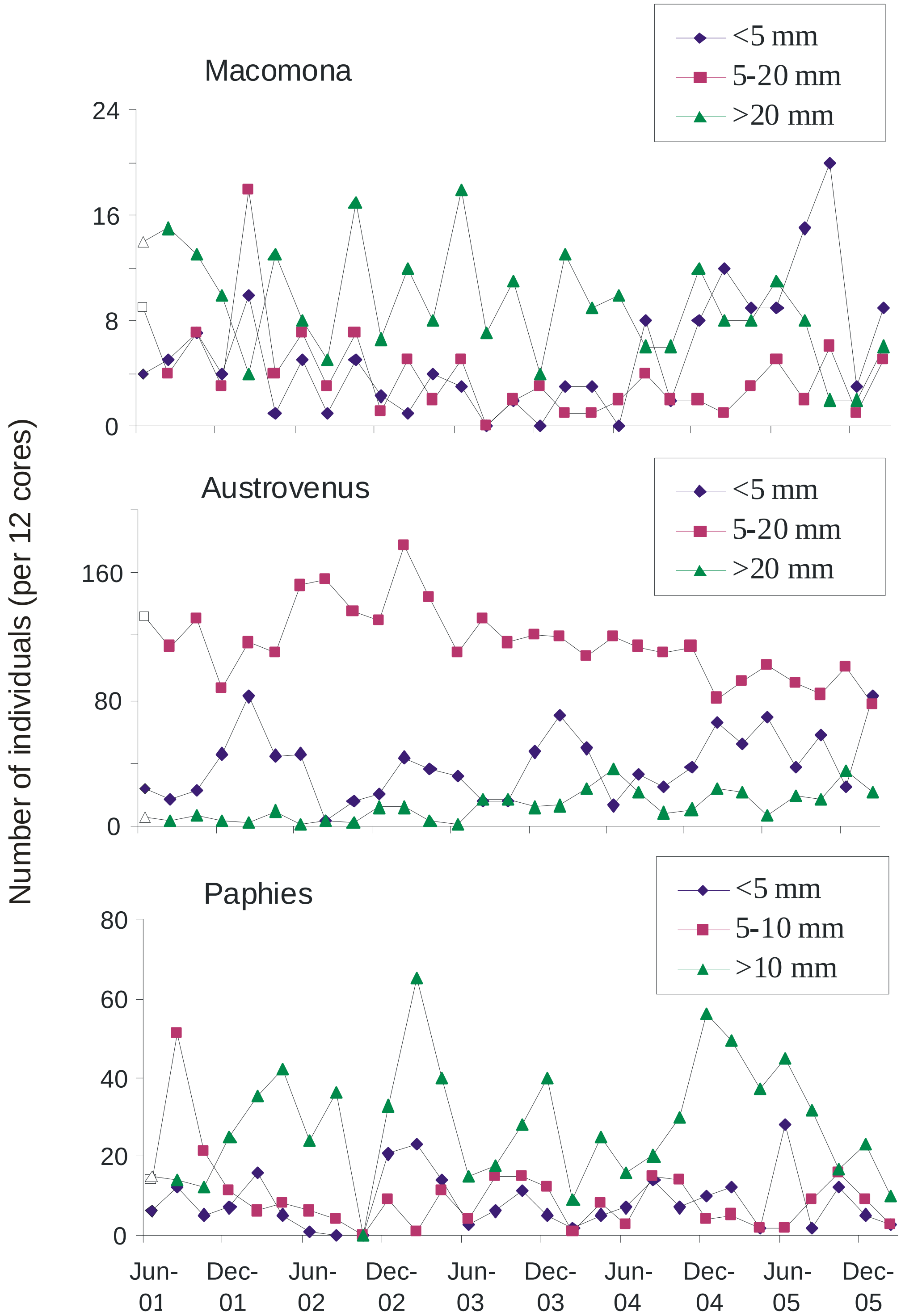


Figure 6:

The abundance of different size classes of *Austrovenus* and *Paphies* found over time at site HBV.



4.2.2 Henderson Creek (HC)

Like HBV, *Nucula* was by far the most abundant species monitored; in fact *Nucula* is still more abundant at HC than at any other monitored site. *Austrovenus*, *Notoacmea*, and the polychaetes *Aricidea* sp. and *Aquilaspio aucklandica* were also common (Table 7). Abundances of *Austrovenus* were not predominantly driven by first year juveniles; large numbers of adults (>20 mm) and intermediate sized individuals were generally found (Fig. 4 & 6). The polychaete *Boccardia syrtis*, the anemone *Anthopleura aureoradiata* and the gastropods *Diloma subrostrata* and *Zeacumantus lutulentus* were occasionally ranked amongst the top 5 taxa. Abundances of *Macomona* were lower than at HBV, but seasonal recruitment of juvenile *Macomona* dominated the size structure over the last three years (Fig. 8).

Table 7:

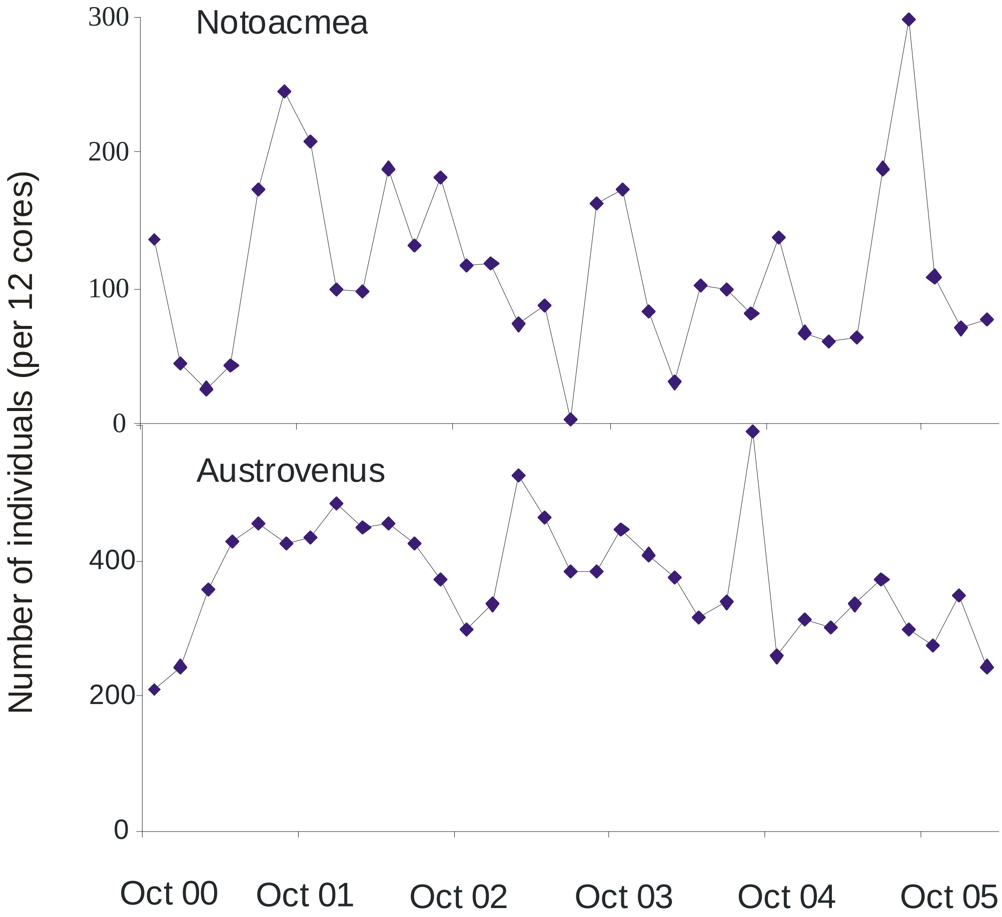
The three most abundant monitored taxa found over time at HC.

Date	Most abundant	⇨	Least abundant
Oct-00	*Nucula*	*Austrovenus*	*Notoacmea*
Oct-01	*Nucula*	*Austrovenus*	*Aricidea*
Oct-02	*Nucula*	*Austrovenus*	*Aricidea*
Oct-03	*Nucula*	*Austrovenus*	*Notoacmea*
Oct-04	*Nucula*	*Austrovenus*	*Notoacmea*
Oct-05	*Nucula*	*Austrovenus*	*Aricidea*

Similar to the HBV site, the site was dominated by a few, reasonably abundant taxa, with abundances of other taxa remaining fairly low. To date, this site has the highest number of taxa exhibiting seasonal and multiyear cycles in abundance (Table 6). Multiyear cycles in abundance were again observed for *Austrovenus, Anthopleura*, *Notoacmea* and *Aricidea* (Table 6, Fig. 6). In addition to multiyear cycles in abundance *Anthopleura* and *Notoacmea* also exhibited annual cycles in abundance (Table 6, Fig 7). Recruitment of *Austrovenus* occurred regularly in February, although sizes of recruitment peaks were variable between years (Fig. 7) leading to a multiyear cycle in abundance. Multiyear cycles in abundance were also noted in the bivalve *Nucula* and the gastropod. *Exosphaeroma* and *Macroclymenella* both exhibited seasonal cycles in abundance. The polychaete *Aquilaspio* continues to decline in abundance since a large recruitment peak in October 2001 (Fig 7). *Boccardia* exhibited declining abundances over the monitored period (~100 to 10 individuals, see Fig. 7). Over the last two years, two species have exhibited significant increases in abundance, *Zeacumantus* and *Anthopleura* (Fig. 7). Three species exhibited high variability in abundance: *Macomona* (similar to HBV), *Colurostylis* and the bivalve *Arthritica bifurca*. Even when size classes of *Macomona* were plotted, no coherent pattern was observed (Fig. 8).

Figure 7:

At HC, *Notoacmea* exhibited annual recruitment in August – October and a multiyear cycle in abundance. *Austrovenus* exhibited multiyear cycles. *Boccardia* and *Aquilaspio* exhibited declining abundances over the monitored period and *Zeacumantus* and *Anthopleura* exhibited increasing abundance over the last two years of monitoring.



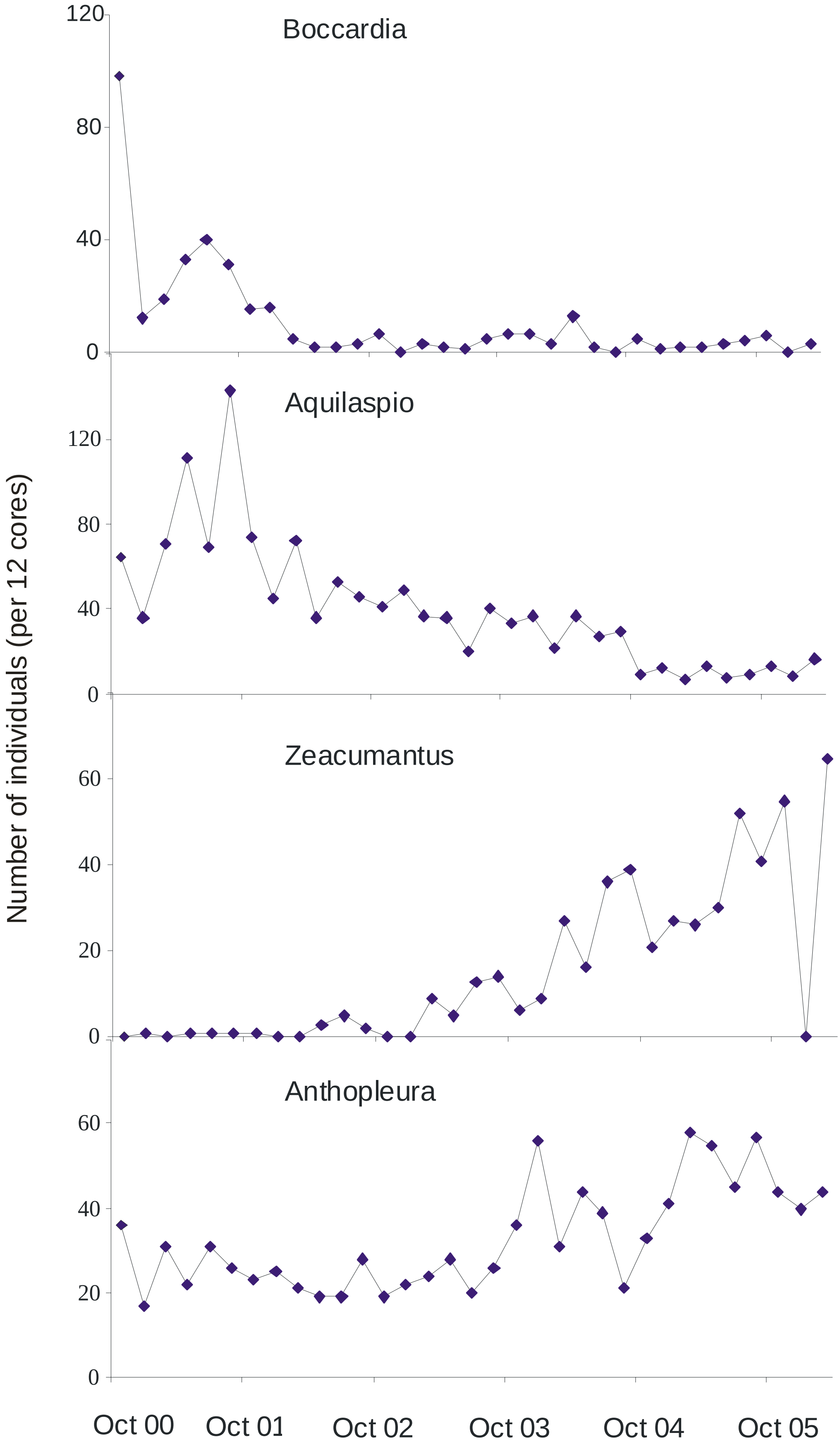
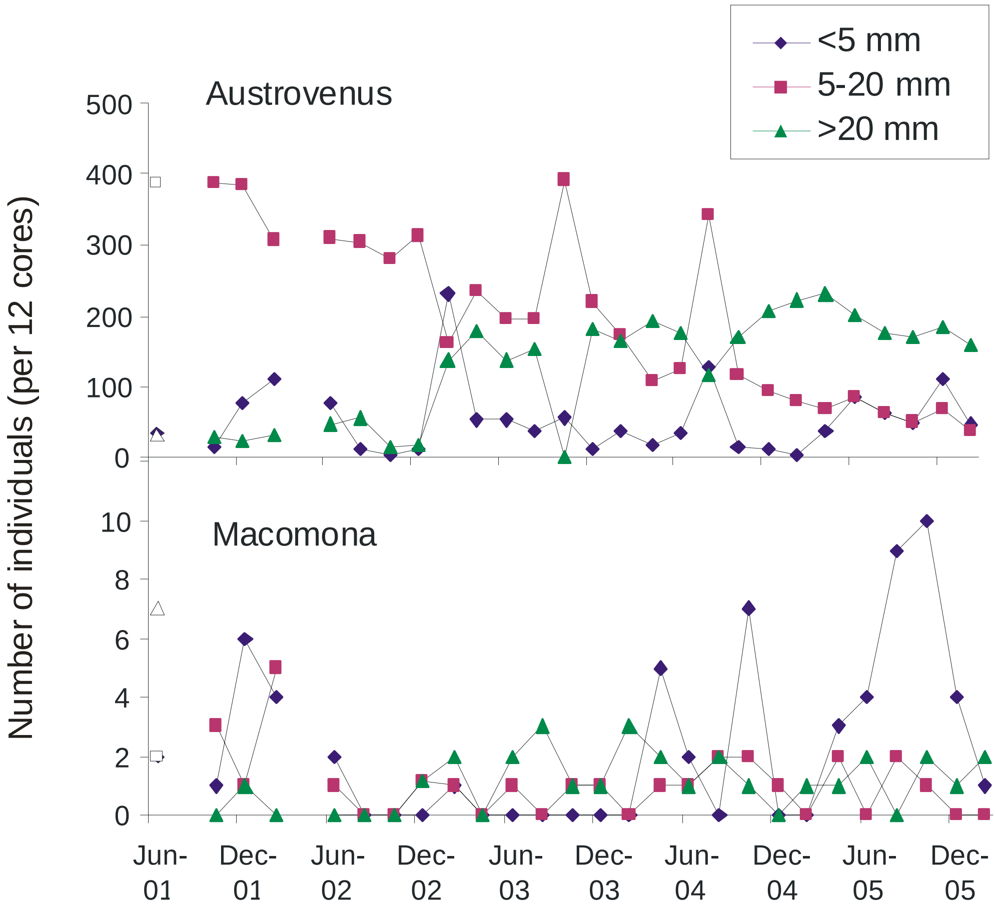

Boccardia
Aquilaspio
Zeacumantus
Anthopleura
Number of individuals (per 12 cores)
120
80
40
0
120
80
40
0
60
40
20
0
60
40
20
0
Oct 00
Oct 01
Oct 02
Oct 03
Oct 04
Oct 05

Figure 8:
The abundance of different size classes of *Austrovenus* and *Macomona* found over time at site HC.



4.2.3 Whau River (Whau)

Nucula was also the most abundant taxa at Whau (Table 8). *Austrovenus* and *Aricidea* were the next most abundant taxa. *Notoacmea, Macomona* and the polychaete *Macroclymenella stewartensis* were among the five most dominant taxa on several occasions. Abundances of *Macomona* were higher at Whau than at the other sites, but the population generally consisted of juveniles (Fig. 4 & 10), suggesting the possibility that this is a sink population. However, as noted for *Austrovenus* at HBV, juveniles may be being produced from nearby channel sites. The gastropod *Haminoea zelandiae* was found here in greater total abundances than at any other monitored site.

Table 8:

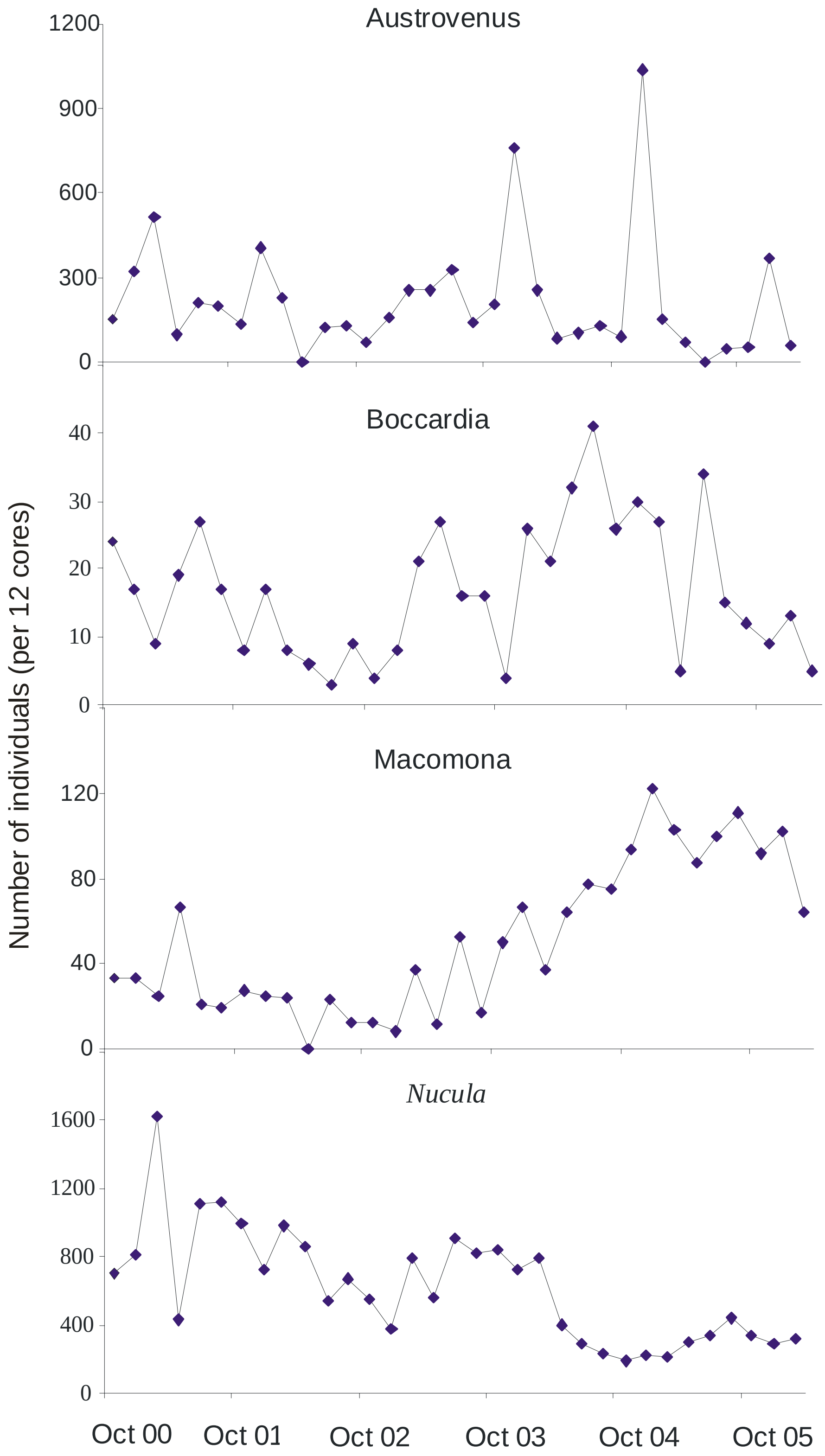
The three most abundant monitored taxa found over time at Whau.

Date	Most abundant	⇨	Least abundant
Oct-00	*Nucula*	*Aricidea*	*Austrovenus*
Oct-01	*Nucula*	*Aricidea*	*Austrovenus*
Oct-02	*Nucula*	*Aricidea*	*Austrovenus*
Oct-03	*Nucula*	*Austrovenus*	*Aricidea*
Oct-04	*Aricidea*	*Nucula*	*Macroclymenella*
Oct-05	*Nucula*	*Aricidea*	*Macroclymenella*

A number of taxa exhibited high variability at this site. The number of juvenile *Austrovenus* peaked markedly in abundance in December 2003, 2004 and 2005 (Fig. 10). During this period however, the abundance of intermediate sized (5 – 20 mm) *Austrovenus* decreased from ~120 to 30 (Fig. 10). Strong *Austrovenus* recruitment was also noted at two other sites, Reef and ShB at the same time (Figs. 12 & 14). Recruitment of *Macomona* was low and variable for the first half of the measured period, higher numbers of juveniles and intermediate sized *Macomona* have appeared in the last three years (October 03 – February 06; Fig. 10). This has lead to an increase in the abundance of Macomona over the monitoring period (Table 6, fig 10). Five taxa (*Nucula, Aricidea, Aquilaspio, Anthopleura* & *Notoacmea*) have exhibited a decrease in abundance over the monitoring period (Fig. 9). The decline in abundance of Anthopleura and *Notoacmea* has only occurred over the last three years. Annual cycles in recruitment were observed in *Austrovenus,* and the polychaete *Boccardia,* also exhibited a multiyear cycle in abundance (Fig 9).

Figure 9:

Austrovenus and *Boccardia* exhibit annual cycles in abundance; *Boccardia* also exhibits a multiyear cycle at Whau. *Aquilaspio* exhibits decreasing abundances over the monitored period, while *Nucula*, *Aricidea*, *Aquilaspio*, *Anthopleura* and *Notoacmea* exhibit declining abundances.



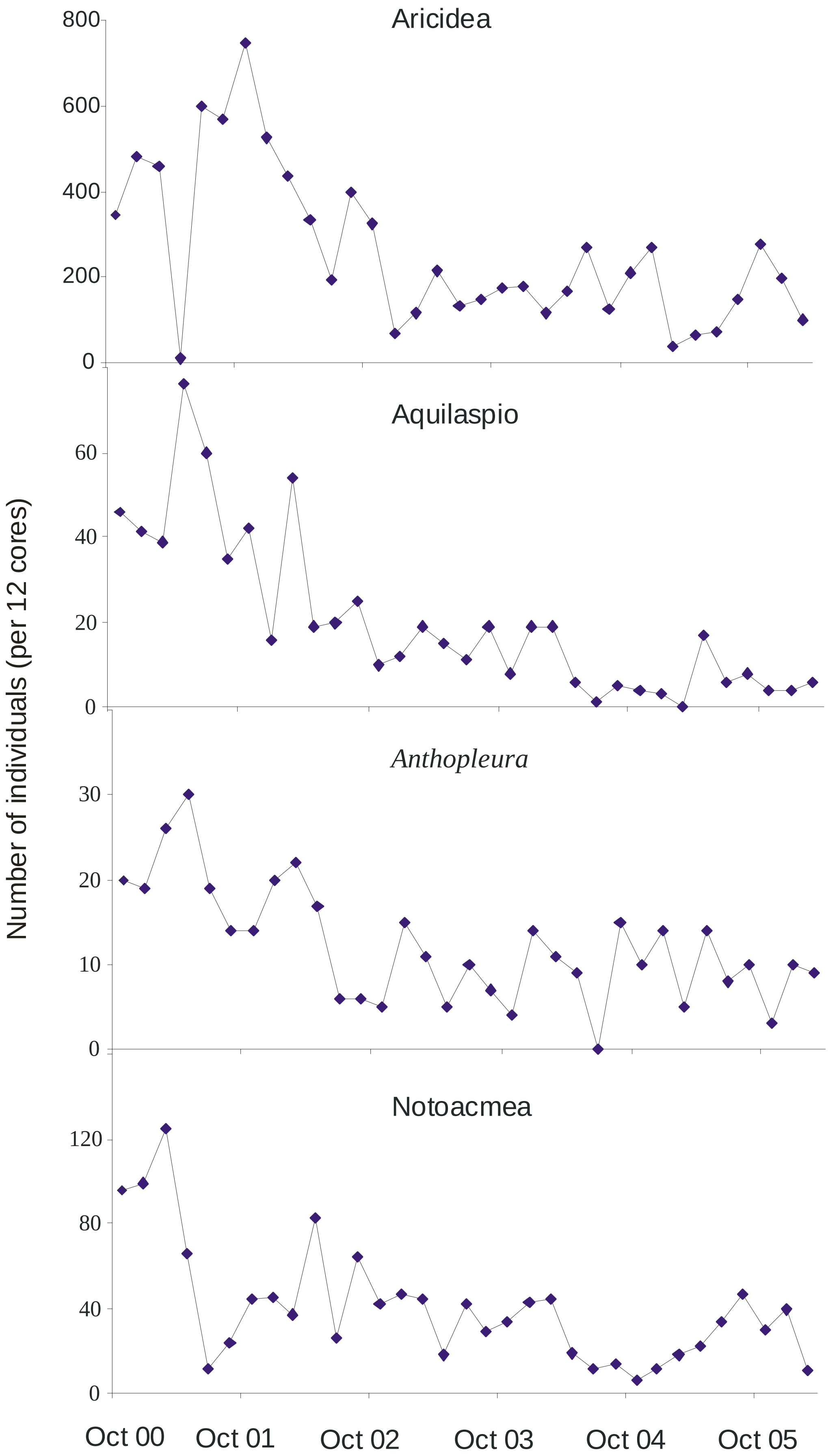
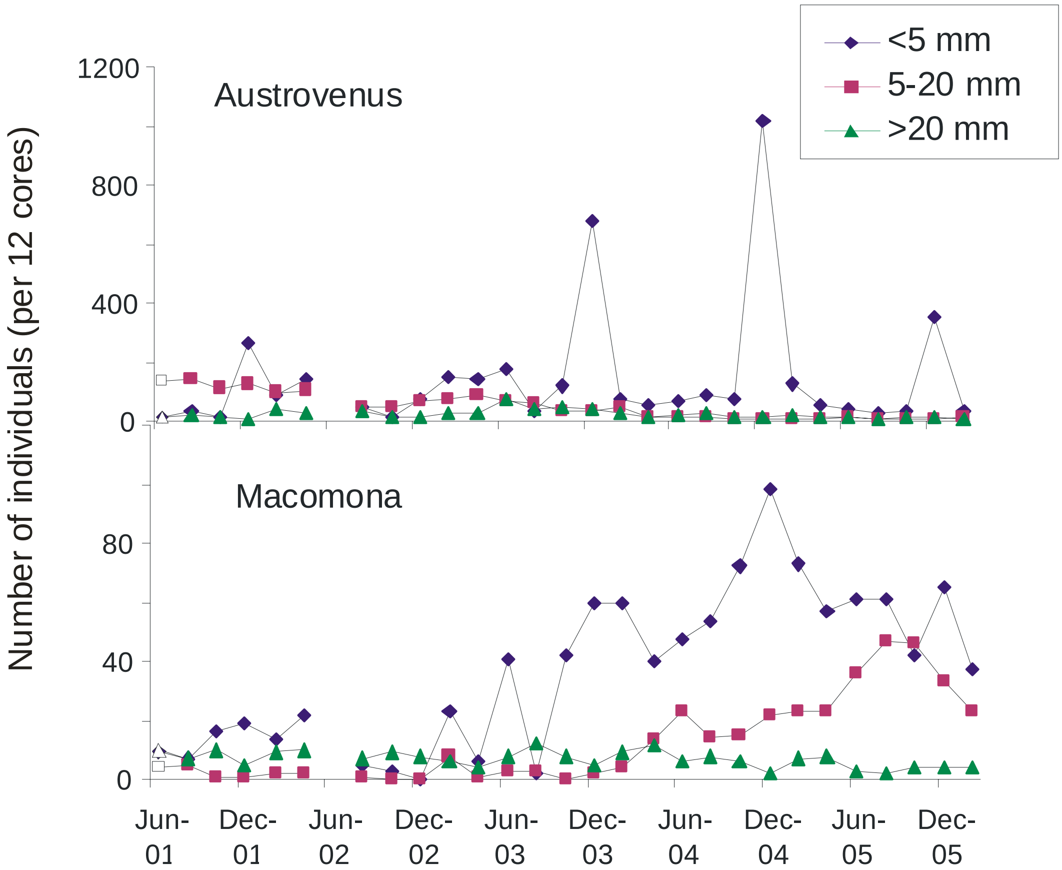

Aricidea
800
600
400
200
0
Aquilaspio
60
40
20
0
Anthopleura
30
20
10
0
Notoacmea
120
80
40
0
Number of individuals (per 12 cores)
Oct 00
Oct 01
Oct 02
Oct 03
Oct 04
Oct 05

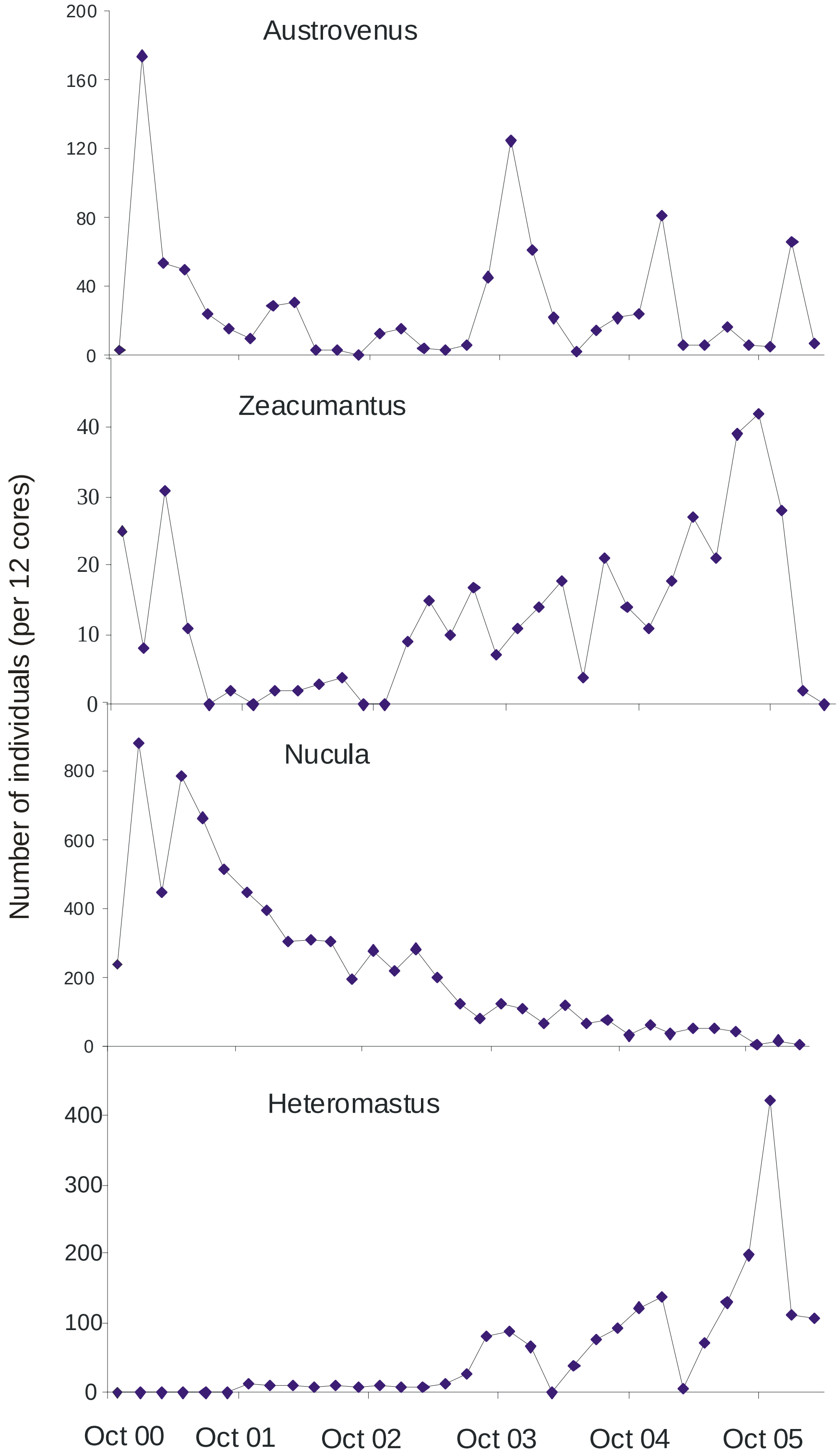
Figure 10:
The abundance of different size classes of *Austrovenus* and *Macomona* found over time at site Whau.



4.2.4 Te Tokaroa Reef (Reef)

Despite this site's proximity to the relatively polluted Meola and Motions Creeks, the benthic taxa are diverse. Reef appears to have fewer surface deposit feeders and more suspension feeders, predators and grazers than the other sites. Abundances of *Austrovenus* are generally lowest at this site and, similar to HBV, consist predominantly of juveniles (Fig. 4 & 12). Of the monitored taxa, *Paphies*, *Arthritica*, *Anthopleura*, *Diloma*, *Exosphaeroma* and *Aonides* are rarely found at this site.

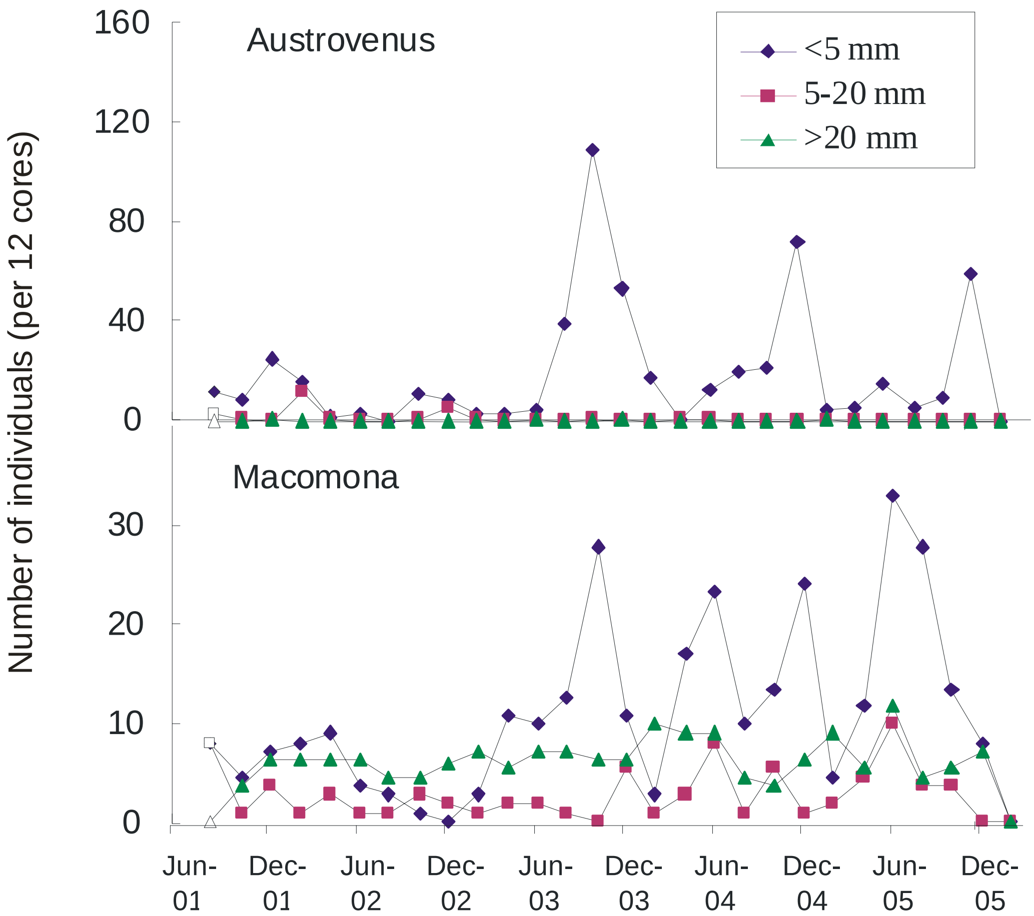
Figure 11:
Highest number of *Austrovenus* occurred at the Reef site in December – February during recruitment peaks. *Austrovenus* also exhibited longer-term trends in abundance, as did *Haminoea*. *Nucula* exhibits increasing abundances over the monitored period whereas abundances of *Nucula* decrease.



Heteromastus and *Nucula* (Fig. 11) both exhibited trends in abundance with *Heteromastus* increasing in density over the monitored period (from 0 – >100 individuals) and *Nucula* decreasing markedly in density from 900 – 3 individuals (Fig. 11). Most *Austrovenus* at this site are sized <5mm (Fig. 12), and the patterns of abundance are driven by year 1 juveniles. Few cockles remain to adulthood at this site. Abundances of *Macomona* are not high, but a mixed population is generally observed (Fig. 4 & 10), with juveniles most numerous during recruitment peaks. As noted at sites Whau and ShB, the size of recruitment peaks in *Austrovenus* and *Macomona* have increased over the last three years.

Figure 12:

The abundance of different size classes of *Austrovenus* and *Macomona* found over time at site Reef.



Aonides and *Glycera* were consistently present in low numbers and the abundance of the gastropod *Zeacumantus lutulentus* was variable. Of the remaining species, 4 exhibited annual patterns of recruitment, 6 exhibited multiyear patterns and two exhibited trends in abundance (Table 6). Highest number of *Arthritica* and *Haminoea* and *Austrovenus* occurred in December – February. *Austrovenus*, *Haminoea*, *Zeacumantus* (Fig. 11) and the polychaetes, *Macroclymenella*, *Aquilaspio*, *Euchone* sp. all exhibited multiyear cycles in recruitment (Table 6).

These multiyear patterns of abundance are reflected in changes to the dominant taxa (Table 9). While the most abundant taxa were relatively consistent for the first few years of sampling, the last year shows a marked change, such that *Nucula* is no longer the most abundant taxa at this site.

Table 9:

The three most abundant monitored taxa found over time at Reef.

Date	Most abundant	⇨	Least abundant
Oct-00	*Nucula*	*Euchone*	*Aricidea*
Oct-01	*Nucula*	*Euchone*	*Aricidea*
Oct-02	*Nucula*	*Euchone*	*Aricidea*
Oct-03	*Euchone*	*Austrovenus*	*Nucula*
Oct-04	*Euchone*	*Heteromastus*	*Aricidea*
Oct-05	*Heteromastus*	*Euchone*	*Aricidea*

4.2.5 Shoal Bay (ShB)

While *Nucula* was again the most abundant species over the first three years, abundances of *Nucula* have been declining at Shoal Bay over the last two-three years (Table 6, Fig. 13) similar to the trends in Nucula abundance at Whau and Reef. *Notoacmea* was frequently abundant, with *Austrovenus*, *Aricidea*, *Boccardia*, *Colurostylis*, *Euchone*, *Aonides* and *Aquilaspio* all being among the five most abundant taxa on more than one occasion. *Macomona* generally exhibited a mix of size classes (Fig. 14), while *Austrovenus* populations have been dominated by large recruitment peaks over the last three years and only low numbers of adults are found (Fig 14).

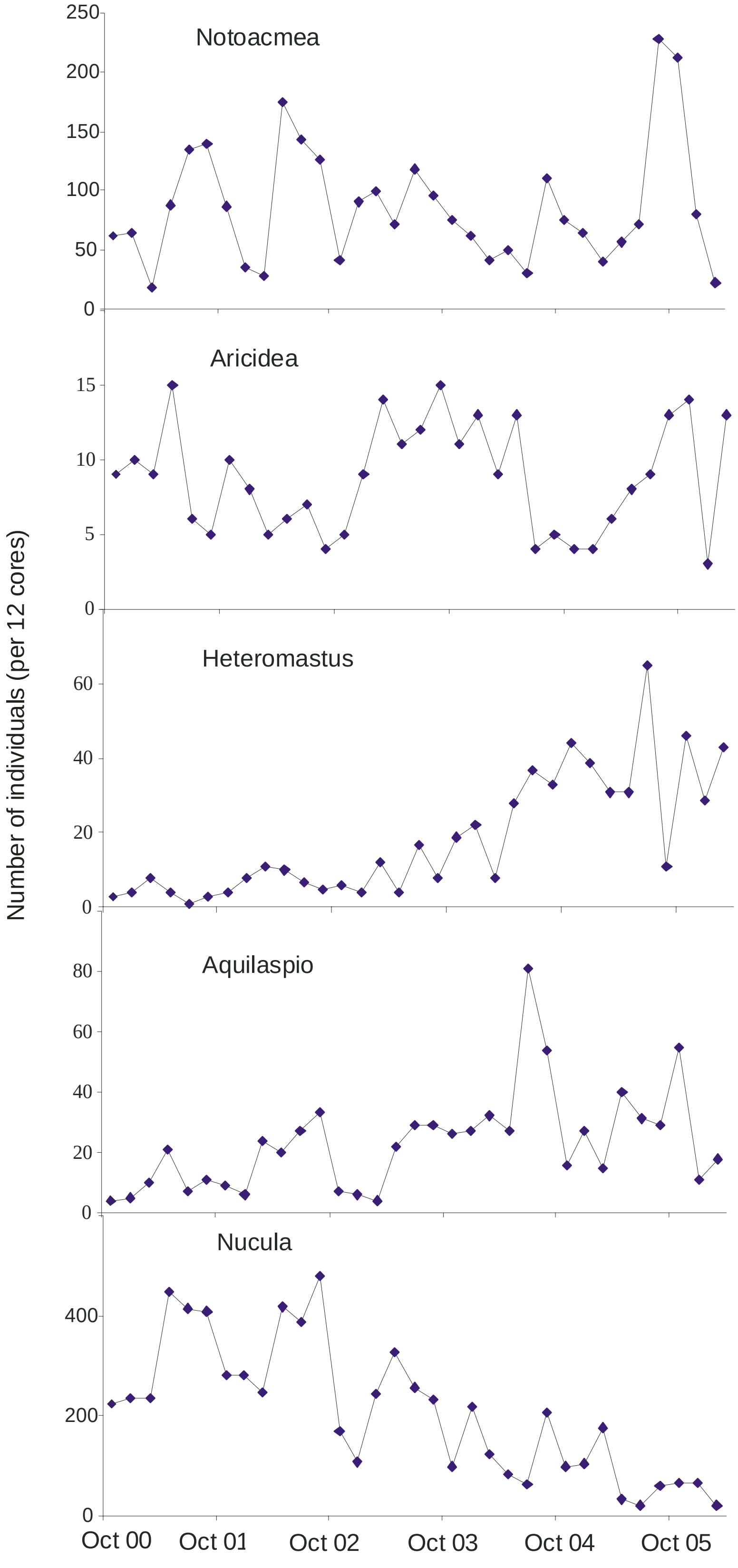
Table 10:

The three most abundant monitored taxa found over time at ShB.

Date	Most abundant	⇨	Least abundant
Oct-00	*Nucula*	*Notoacmea*	*Boccardia*
Oct-01	*Nucula*	*Notoacmea*	*Aricidea*
Oct-02	*Nucula*	*Notoacmea*	*Aricidea*
Oct-03	*Nucula*	*Notoacmea*	*Aricidea*
Oct-04	*Nucula*	*Notoacmea*	*Euchone*
Oct-05	*Notoacmea*	*Boccardia*	*Euchone*

Figure 13:

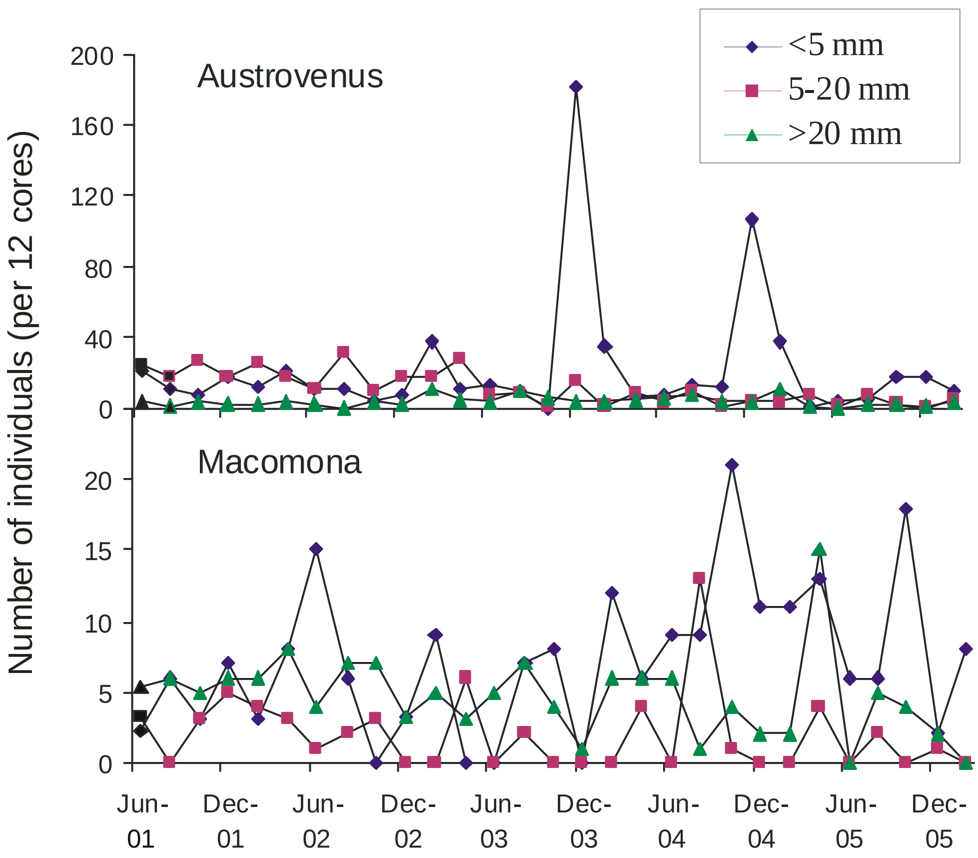
Abundances of *Notoacmea* at ShB exhibit a pronounced seasonal cycle, while abundances of *Aricidea* exhibit multiyear changes. *Heteromastus* and *Euchone* increased in abundance over the monitored period, whereas *Nucula* decreased in abundance.



Notoacmea, *Nucula*, *Aonides* and *Austrovenus* all exhibited seasonal cycles of abundance, although high abundances did not all occur at the same time of the year for all taxa. Moreover, while abundances of *Colurostylis* were variable within each year, multiyear cycles were indicated. Multiyear cycles were also indicated for *Aricidea*, *Anthopleura* and *Euchone*. Recruitment of juvenile *Austrovenus* also varied markedly between years with very high recruitment occurring December 2003 and December 2004 (Fig. 14). *Heteromastus* increased in abundance over the monitored period from a maximum of 8 individuals in the first year of sampling to over 30 individuals in the last year of sampling (Fig. 13). *Aquilaspio* showed exhibited a small increase in abundance over the monitoring period (Fig. 13).

Figure 14:

The abundance of different size classes of *Austrovenus* and *Macomona* found over time at site ShB.



4.3 Are species abundances exhibiting similar patterns at all sites?

Generally, correlation analysis revealed few similarities between patterns in abundances of taxa from different sites (correlation coefficients < 0.5) (Table 11). The highest number of correlations was found between sites located near to one another, even when trends in abundance were removed from the analysis. *Aquilaspio* showed distinct differences between inner and outer sites with strong correlations between HBV, HC and Whau and then between ShB and Reef.

Interestingly, some patterns of abundance that were similar were offset in time. While the majority of correlations were highest at zero lags, *Macrocylmenella*, *Austrovenus* and *Nucula* abundances were usually offset between sites, varying from 2 to 10 months. *Heteromastus* abundances at Whau and Reef, and *Austrovenus* at Whau and HBV were offset by 1.5 years. *Aricidea* abundances at HBV and HC and *Boccardia* at HBV and Reef were offset by 2 years.

It is difficult to isolate causes of abundance lags between sites. However, lags of whole years (e.g., *Aricidea* abundances at HBV and HC and *Boccardia* at HBV and Reef) are likely to be driven by site characteristics. Conversely, lags of months and part years (e.g., 2 to 10 months, 1.5 years) suggest a number of processes interacting across a number of scales.

Table 11:

Number of monitored taxa for which significant cross lag correlations were observed between sites. (a) all significant correlations, (b) correlations > 0.5.

A					B				
	HBV	HC	Reef	ShB		HBV	HC	Reef	ShB
HC	12				HC	5			
Reef	6	8			Reef	1	2		
ShB	9	6	10		ShB	1	2	5	
Whau	8	11	11	6	Whau	2	4	5	2

4.4 Have any changes in species over time led to changes in communities, or sites becoming more or less similar to each other?

4.4.1 Changes in site characteristics

The sites initially formed three distinct groups along a gradient of decreasing fine sand (Nicolls et al. 2002). (1) Reef and Whau were predominantly fine sand with low mud and organic content and medium chlorophyll *a*. (2) ShB and HBV had less fine sand and proportionally more medium and coarse sediment, but were variable with respect to %mud and organic content. (3) HC had the lowest percentage fine sand and the highest % of mud and coarse sediment fractions. It also had the highest organic content and chlorophyll *a*.

Over time these groupings have changed (Fig. 3). (1) Reef and Whau have become more dissimilar, although this is being driven by increased variability over time at Reef in %mud, rather than a clear separation in site characteristics. These changes at Reef are unlikely to be associated with seagrass growth at the site, as this did not occur until December 2004. Moreover, when seagrass patches expanded into the Manukau site CB no community changes were observed. (2) After the first 1.5yrs sediment characteristics at HBV changed, with increased proportion of coarse fractions, while ShB did not change. (3) Over the first 5 years, increased % fine sand and mud was observed at HC, making the site more similar to ShB. This site has continued to show changes over the last 1.5 yr associated with increased organic content.

4.4.2 Changes in communities

Initially, all sites were distinctly different, with HC and Whau being the most similar. This is still the case, with only two of the sites showing distinct changes in community structure over time (Fig 15a). The largest changes are occurring at Reef, where large decreases in *Nucula* and large increases in *Heteromastus* have been observed. While decreases in the abundance of *Nucula* have also occurred at Whau and ShB, *Nucula* was not the most dominant species at Whau and, at ShB, the magnitude of change has not been so marked. Again while *Heteromastus* is also increasing at ShB, the magnitude of the change is not so great as to move *Heteromastus* into a dominant position. Multivariate ordination based on presence absence data exhibited no strong changes over time at the sites (Fig 15b).

Trends in the abundance of the monitored species are apparent at all sites, although Whau and HC have more taxa displaying trends than the other sites (Table 6). At Whau, these do not result in strong changes in community structure because the relative abundance of the dominant taxa is largely maintained. Also within-year variability is high, and changes in abundance of all taxa are not occurring over the same period. At HC, none of the taxa exhibiting trends in abundance are dominant, the changes are generally small relative to with-in year variation and many taxa exhibit multiyear cycles.

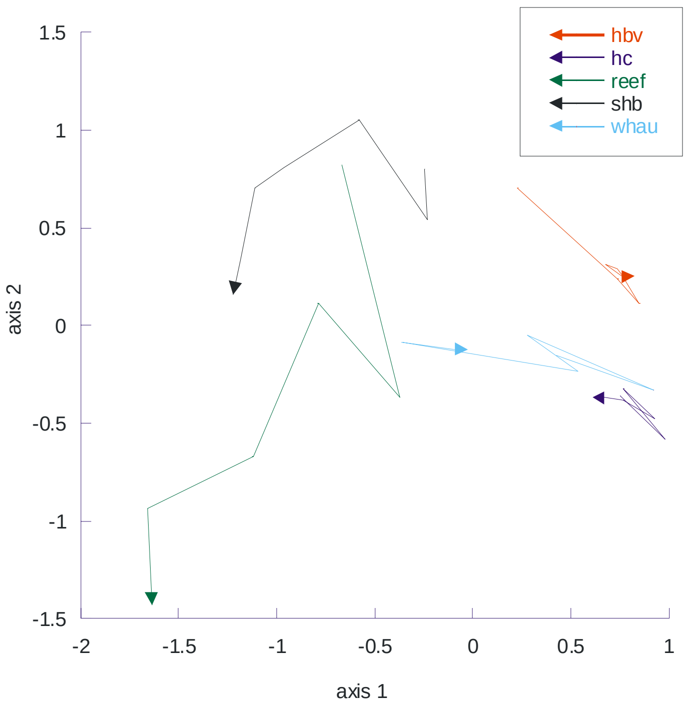
There are some patterns in the trends in abundance. (1) *Heteromastus* is increasing in abundance at the two outer sites (ShB and Reef). (2) *Nucula* is decreasing in abundance at the three outer sites (ShB, Reef and Whau). (3) *Aquilaspio* is decreasing at the three inner sites (Whau, HC and HBV). (4) *Zeacumantus* and *Anthopleura* are decreasing/ increasing at the two inner sites (HC and HBV). These changes do not seem to be related to changes in sediment characteristics.

The differences between the site groupings and changes over time observed for the sediment characteristics and the community composition, as well as the lack of correlation between sediment characteristics and the changes in the 5 species noted in the previous paragraph, suggests that community composition is not being purely driven by our measured sediment characteristics. The two sites most similar in community composition are located on the same large intertidal flat that stretches between the entry of the Henderson Creek and the Whau River, suggesting that recruitment and dispersal dynamics may be playing a role.

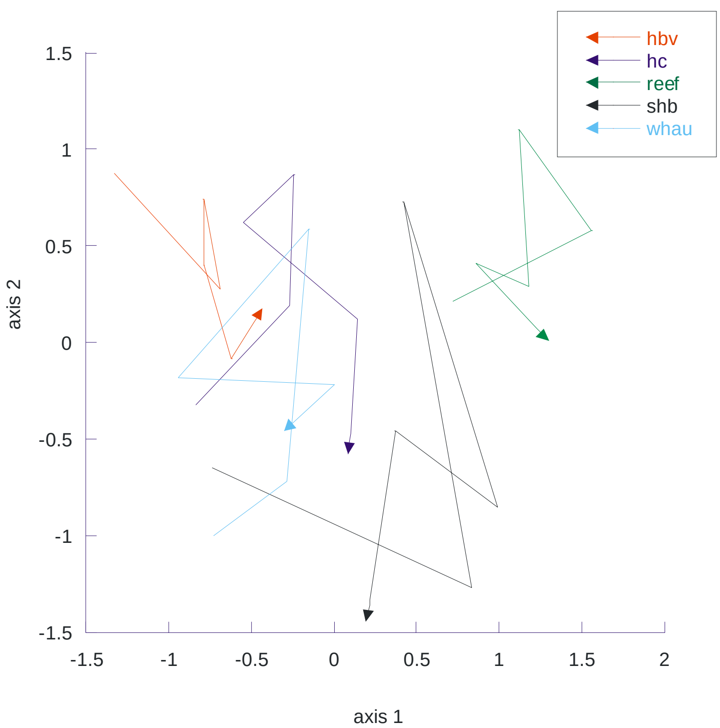
Figure 15:

Multidimentional Scaling (MDS) plot of the community structure of each site during October 2000 - 2005 (a) using abundance data (b) presence/ absence data

(a)



(b)



5 Information useful to the Central Waitemata modeling project

A crucial factor in the Central Waitemata modeling project is defining levels of bioturbation (i.e., the degree to which animals move sediment around) around the harbour, as bioturbation affects the calculation of sedimentation rates. Certain types of bioturbators also affect contaminant cycling, moving sediments up or down the sediment column. Bioturbators that move on the sediment surface can increase the potential for sediment resuspension, thus promoting the spread of contaminated sediment.

Bioturbation at each of the sites was determined by using functional characteristics to place taxa into a number of bioturbating categories: animals that maintain vertical burrows; animals that move sediment up or down the sediment column; surface bioturbators; and animals that move horizontally within the sediment. Size of the bioturbating organism will, together with density, affect bioturbation rates, so taxa were sorted into large (>2 cm longest dimension), medium (1 – 2 cm) and small (<1 cm). Depth of bioturbation was assessed on the basis of knowledge of functional characteristics and using horizontally segmented cores. Three categories were used: shallow (top 2 cm); medium (2 – 10 cm); and deep (2 – 15 cm). Numbers of taxa in all categories were calculated for each site in October. To investigate temporal variations in bioturbation, calculations were done for all taxa in each October and for all monitored species over the complete temporal series.

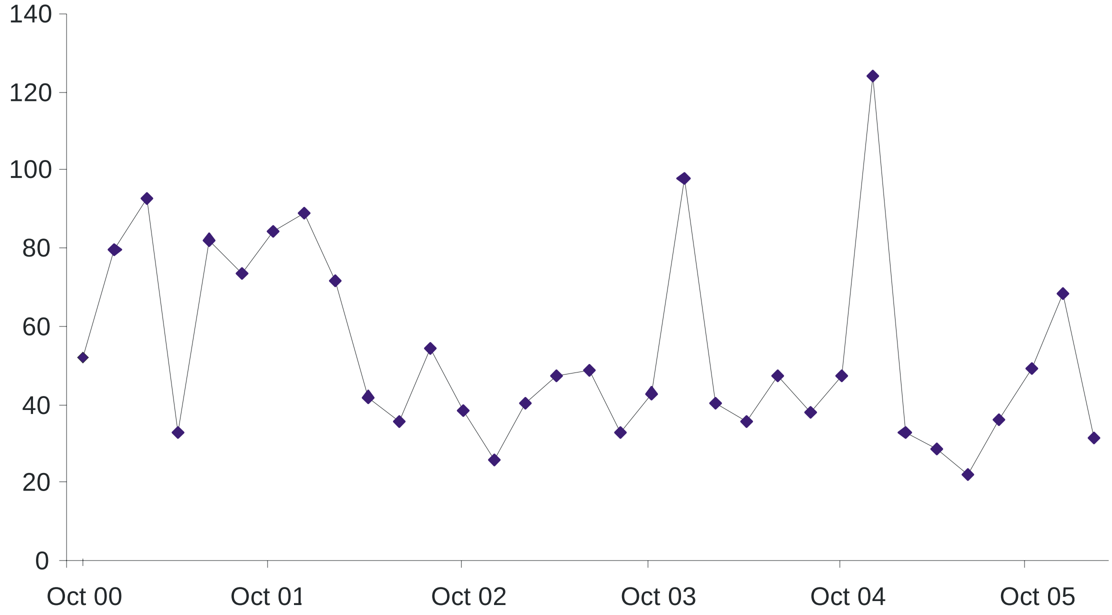
The density of bioturbators was lowest at SHB followed by Reef. Whau had high densities of bioturbators but these were mainly small. HbV and HC had the highest densities of bioturbators with HC having mainly large sized animals and HbV having mainly medium sized animals.

Differences also occurred between the sites in the types of bioturbators and the depths to which bioturbation occurred. HbV and Whau had few burrowers or animals working sediment vertically; most were animals that moved horizontally through the sediment. At HC bioturbators were mainly surface bioturbators. Reef and ShB both had more burrowers and animals vertically moving sediment. All sites had animals that bioturbated down to at least 15 cm, but densities of deep bioturbators were highest at Reef, ShB and Whau. Surface bioturbators dominated at HC and Whau.

Perhaps the most important information that this monitoring programme can offer the Central Waitemata modeling programme is an estimate of the degree to which bioturbation can vary temporally. Both seasonal cycles and multiyear cycles were observed in the densities of bioturbators at the sites (see Figure 15 for an example). The degree of temporal variation observed can be utilized in the models to determine likely ranges of effect.

Figure 15

Density of bioturbators (total in 12 cores) at site Whau over time.



6 Conclusions and recommendations

While slight changes in sediment characteristics have occurred at all sites over the monitored period, no large, uni-directional shifts were recorded (e.g., a site changing from being predominantly sandy to sandy mud). Moreover, these changes do not appear to have affected the benthic communities present at each site. Rather, similarities among adjacent sites, particularly Henderson Creek and the Whau River, suggest that recruitment and dispersal dynamics may be key drivers of biological change.

Five taxa displayed trends in abundance. (1) *Heteromastus* is increasing in abundance at the two outer sites (ShB and Reef). (2) *Nucula* is decreasing in abundance at the three outer sites (ShB, Reef and Whau). (3) *Aquilaspio* is decreasing at the three inner sites (Whau, HC and HBV). (4) *Zeacumantus* is decreasing at the two inner sites (HC and HBV). (5) *Anthopleura* is increasing at the two inner sites (HC and HBV). Furthermore, while correlations between the Southern Oscillation Index and abundances are strong for *Heteromastus*, *Nucula* and *Aquilaspio*, the time series dynamic models did not remove the observed trends with time, except for *Heteromastus* at Reef.

It is important to note that monitoring has only been going for 5 ½ years. Apparent, uni-directional trends in abundance may therefore turn out to be components of longer-term cycles. Long-term ecological monitoring in Manukau Harbour shows many species, such as *Anthopleura* and *Aquilaspio*, display cycles of 6 – 9 years. Declines in *Nucula* populations have also been noted in the Mahurangi, and there is a reasonable likelihood that the changes observed in this species reflect a cyclic population dynamic rather than continuous loss. For *Zeacumantus,* which is rare at monitored sites in the Manukau and Mahurangi, it is difficult to predict whether the observed changes are part of natural cycles.

Based on available species sensitivities information, the changes in abundance seem unlikely to be associated with either increased sedimentation or contamination. The reasons for this are:

- Changes is sensitive taxa would be expected to occur before strong changes were observed in relatively robust taxa such as *Heteromastus* and *Nucula*.
- Relatively sensitive taxa such as *Anthopleura* and *Aquilaspio* would both be expected to respond negatively to sediments and contaminants. However, *Anthopleura* abundance has increased at some sites, while *Aquilaspio* has decreased.

Having said that, a lack of good sensitivity information makes the assessment of cause and effect difficult. Information obtained from ARC and NIWA research on toxicology and community health will assist with this.

While a number of invasive species have been recorded in the Waitemata only 6 invasive species were found over the monitored period at the monitored sites (*Musculista senhousia*; *Theora lubrica*; *Chaetopterus* sp. A , *Pseudopolydora corniculata*, *Monocorophium acherusicum* & *M. sextonae*). However, the lack of temporal consistency or increasing densities recorded for these suggest they are unlikely to pose a problem.

Further changes at Reef may occur, associated with seagrass growth at the site. Although previous observations in Manukau at site CB found no effect of seagrass on community structure, we recommend, if seagrass growth continues, that samples taken in and out of seagrass are processed separately, and measurements are made of the area of the site covered by seagrass.

7 Plates

Plate 1.
The Hobsonville area with a close-up of site HBV.

Plate 2.

The sandflat near Henderson Creek area with a close-up of site HC.

Plate 3.

The sandflat near Whau River with a close-up of site Whau.

Plate 4.

The sandflat near Te Tokaroa Reef with close-ups of sediment in February 2006, Seagrass patch in February 2006 and diatom covered sediment in June 2005.

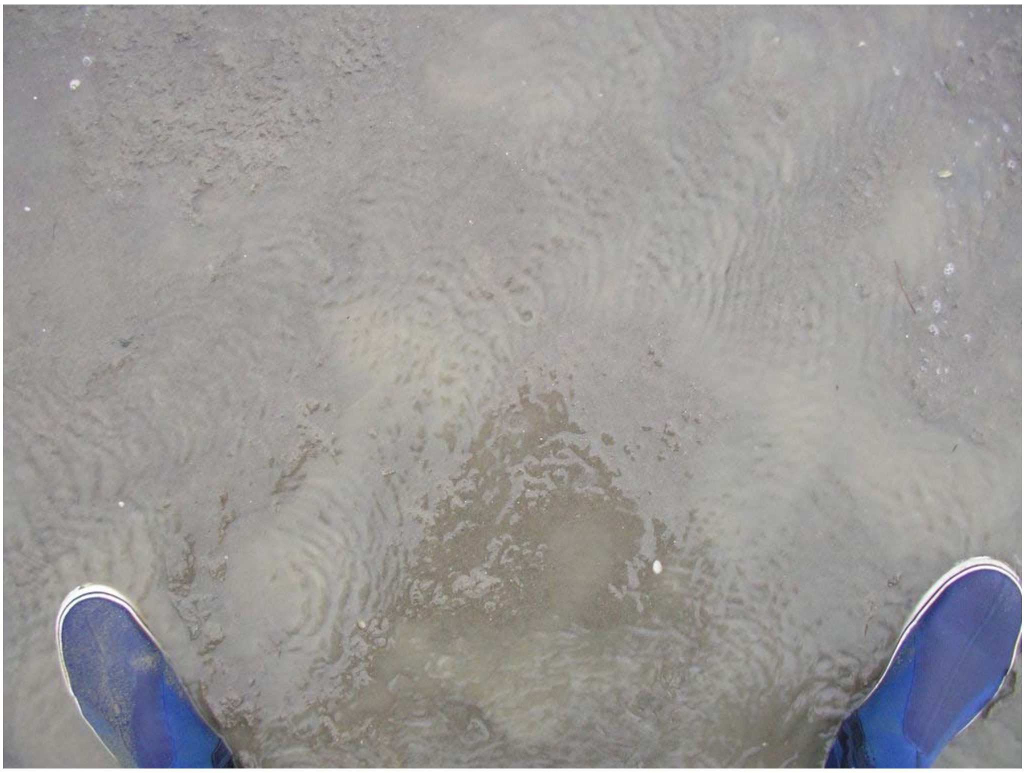


Plate 5.

A sandflat in Shoal Bay with a close-up of site ShB.

8 Acknowledgements

Thanks to Mike McMurtry, Marcus Cameron, Dr Shane Kelly and others from ARC for their help in the field.

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10 Appendices

10.1 Appendix 1: Sensitivity of monitored taxa to sediments.

Summary of monitored taxa's sensitivity to increases in fine sediment, both as sedimentation and suspended sediment (SS), collated from Norkko et al. (2001), Berkenbusch et al. (2001), Nicholls et al. (2003) and Gibbs & Hewitt (2004).

Order	Taxa	Info on sensitivity to fine sediment	Sensitivity ranking
Bivalvia	*Arthritica bifurca*	In field surveys, this species was found to prefer sites with a medium proportion of silt/clay, although this data was based on low abundances	low
	Austrovenus stutchburyi	Sensitive in field surveys and medium levels of SS. Found in sed with 0-60% silt clay, prefers 5-10% silt/clay. Sensitive to burial by thin layers (0.5-1.5 cm) of terrestrial clay.	medium
	Macomona liliana	Sensitive to high levels of SS. Macomona survival was decreased in high SS (750 mgL-1 lab trials. In field surveys, this species was found to prefer sites with a low silt/clay proportion (<5%), but occurs in sites with up to 60% fines.	sensitive
	Nucula hartvigiana	Partially sensitive to burial by thin layers (0.5-1.5 cm) of terrestrial clay. In field surveys, this species was found to prefer sites with a low silt/clay proportion (<5%), but occurs at a wide range of sediment types (0-60%).	medium
	Paphies australis	Sensitive to burial by thin layers (0.5-1.5 cm) of terrestrial clay. Species prefers sites with a low proportion of silt/clay. Only occurs in sites with les than 5% fines	highly sensitive
Cnidaria	*Anthopleura aureoradiata*	In field surveys, this species was found to prefer sites with a low silt/clay proportion (5-10%), but occurs at a slightly wide range of sediment types (0-15%).	highly sensitive
Cumacea	*Colurostylis lemurum*	In field surveys, this species was found to prefer sites with a low silt/clay proportion (<5%), but occurs at a wide range of sediment types (0-60%).	sensitive

Gastropoda	*Diloma subrostrata*	In field surveys, this species was found to prefer sites with a low silt/clay proportion (5-10%), but occurs at a slightly wide range of sediment types (0-15%).	highly sensitive
	Haminoea zelandiae	No info	
	Notoacmea sp.	In field surveys, this species was found to prefer sites with a low silt/clay proportion (<5%), but occurs at a slightly wide range of sediment types (<10%).	highly sensitive
	Zeacumantus lutulentus	Not sensitive in lab trials of SS	low
Isopoda	*Exosphaeroma* spp.	No info	
Polychaeta	*Aonides oxycephala*	V. sensitive in field surveys Prefers sediment with 0-5% silt/clay. Sensitive to burial by thin layers (0.5-1.5 cm) of terrestrial clay.	highly sensitive
	Aquilaspio aucklandica	Sensitive to burial by thin layers (0.5-1.5 cm) of terrestrial clay. In field surveys this species showed no preference for sites with a particular proportion of silt/clay.	sensitive
	Aricidea sp.	In field surveys, this species was found to occur at sites with a wide range of sediment types, but preferred sites with a mud content less than 70%.	low
	Boccardia syrtis	Sensitive to high levels of SS (750 mg/l_L) in lab experiments Boccardia stopped feeding under high SS concentrations. Not sensitive to burial by thin (0.5-1.5 cm) layers of terrestrial clay, but sensitive to thick layers (3-9 cm). In field surveys, this species was found to prefer sites with less than 10-15% fines.	medium
	Euchone sp.	No info	
	Glycera sp.	Not sensitive to burial by thick layers (3-9 cm) of terrestrial clay. In field surveys, this species was found to occur at sites with a wide range of sediment types.	low
	Heteromastus filiformis	In field surveys, this species was found to occur at sites with a wide range of sediment types.	low
	Macroclymenella stewartensis	In field surveys, this species was found to occur at sites with a wide range of sediment types (0-60%), although its density was highest at sites with a low proportion of silt/clay (10-15%).	medium

10.2 Appendix 2: Sensitivity of species to contaminants

The form of response observed for the monitored taxa to sediment concentrations of copper (Cu), zinc (Zn) and lead (Pb). NR = no response, L = linear, T = threshold, B = bell shaped, unimodal response, low abundance increasing to a maximum then decreasing again, NA = not available.

Order	Taxa	Cu Sensitivity		Zn Sensitivity		Pb Sensitivity	
		Response shape and max density range (PPM)					
Bivalvia	*Arthritica bifurca*	B	10-35	B	70-220	B	20-80
	Austrovenus stutchburyi	B	10-30	B	70-160	B	20-50
	Macomona liliana	B	5-10	B	20-70	B	10-20
	Nucula hartvigiana	B	15-25	B	70-170	B	25-50
	Paphies australis	NA		NA		NA	
Cnidaria	*Anthopleura aureoradiata*	NA		NA		NA	
Cumacea	*Colurostylis lemurum*	NA		NA		NA	
Gastropoda	*Diloma subrostrata*	NA		NA		NA	
	Haminoea zelandiae	NA		NA		NA	
	Notoacmea sp.	NA		NA		NA	
	Zeacumantus lutulentus	NA		NA		NA	
Isopoda	*Exosphaeroma* spp.	NA		NA		NA	
Polychaeta	*Aonides oxycephala*	B	15-25	B	70-120	B	20-40
	Aquilaspio aucklandica	L	<5	L	<50	L	<5
	Aricidea sp.	L	<10	L	<20	L	<10
	Boccardia syrtis	L	<5	L	<50	L	<10
	Euchone sp.	NA		NA		NA	
	Glycera sp.	NA		NA		NA	
	Heteromastus filiformis	NA		NA		NA	
	Macroclymenella stewartensis	L	<10	L	<50	L	<10

10.3 Appendix 3: Invasive species found in Waitemata Harbour

Taxon	Species	Family	Probable native range
Algae	*Codium* fragile ssp. *tomentosoides*	Codiaceae	Northwest Pacific (adventive in Africa, the northeastern and northwestern Atlantic, North and South America, the Mediterranean, eastern Pacific, Australia)
Algae	*Colpomenia durvilleae*	Scytosiphonaceae	Northern Pacific N. Japan - central California
Algae	*Cutleria multifida*	Cutleriaceae	Cosmopolitan in temperate seas
Algae	*Hydroclathrus clathratus*	Scytosiphonceae	Cosmopolitan temperate & tropical seas
Algae	unidentified species	Solieriacae	Probably Southeast Asia
Algae	*Undaria pinnatifida*	Alariaceae	Japan, Korea, parts of China
Amphipoda	*Chelura terebrans*	Cheluridae	Cosmopolitan
Amphipoda	*Corophium acutum*	Corophiidae	Coasts of Europe; now circumglobal
Amphipoda	*Ericthonius pugnax*	Ischyroceridae	South East Asia (adventive in Australia)
Angiospermae	*Spartina alterniflora*	Poaceae	Eastern USA
Angiospermae	*Spartina anglica*	Poaceae	Britain
Angiospermae	*Spartina townsendi*	Poaceae	Britain
Ascidiacea	*Asterocarpa cerea*	Styelidae	South Australia & Sub-Antarctica
Ascidiacea	*Botrylloides magnicoecum*	Styelidae	Southern African coasts (now adventive on coasts of Australia, New Zealand, and the Mediterranean)
Ascidiacea	*Botryllus schlosseri*	Styelidae	Atlantic
Ascidiacea	*Ciona intestinalis*	Cionidae	Europe?
Ascidiacea	*Corella eumyota*	Rhodosmatidae	Southern & western Australia
Ascidiacea	*Cystodytes dellechiajei*	Polycitoridae	Warm water cosmopolitan
Ascidiacea	*Didemnum "candidum"*	Didemnidae	Now cosmopolitan
Ascidiacea	*Diplosoma listerianum*	Didemnidae	South Africa, now cosmopolitan
Ascidiacea	*Styela plicata*	Styelidae	Cosmopolitan
Ascidiacea	*Styela clava*	Styelidae	Japan, Korea, northern China, (adventive in NW Europe, California, Eastern USA, southern Australia)
Ascidiacea	*Aplidium phortax*	Polyclinidae	Northeastern Australia, Solomon Islands
Ascidiacea	*Botrylloides leachii*	Styelidae	English Channel
Cirripedia	*Balanus amphritrite*	Balanidae	Cosmopolitan warm temperate & tropical seas
Cirripedia	*Balanus trigonus*	Balanidae	Cosmopolitan warm temperate & tropical seas
Cirripedia	*Balanus variegatus*	Balanidae	Indo-Malaysia to Australia
Cnidaria	*Coryne pusilla*	Corynidae	All European coasts, Mediterranean; now also South Africa, East Asia
Cnidaria	*Diadumene lineata* (Sagartia luciae)	Diadumenidae	Cosmopolitan
Cnidaria	*Ectopleura crocea*	Tubulariidae	NE USA, Europe Japan, NE Pacific
Cnidaria	*Eudendrium ritchiei*	Eudendriidae	South Africa
Cnidaria	*Hoplangia durotrix*	Caryophyllidiidae	NE Atlantic
Cnidaria	*Pennaria disticha*	Pennariidae	Europe; now circum- global in warm water
Cnidaria	*Tethocyathus cylindraceus*	Caryophylliidae	W. Atlantic

Taxon	Species	Family	Probable native range
Cnidaria	*Bougainvillia muscus*	Bougainvillidae	North Atlantic
Cnidaria	*Clytia hemisphaerica*	Campanulariidae	Atlantic
Cnidaria	*Obelia bidentata*	Campanulariidae	North Atlantic
Decapoda	Charybdis japonica	Portunidae	Japan, Korea, Northern China, Malaysia
Decapoda	*Merocryptus lambriformis*	Leucosidae	Southern Australia (adventive Japan)
Decapoda	*Pilumnopeus serratifrons*	Xanthidae	South Australia
Decapoda	*Plagusia chabrus*	Grapside	West Indo-Pacific
Decapoda	*Pyromaia tuberculata*	Majidae	West coast North America (adventive Japan)
Entoprocta	*Amathia distans*	Vesiculariidae	Atlantic coast of America, North Carolina to Brazil
Entoprocta	*Anguinella palmata*	Nolellidae	Southern Europe
Entoprocta	*Bowerbankia gracilis*	Vesiculariidae	Eastern North America
Entoprocta	*Bugula flabellata*	Bugulidae	Probably European waters
Entoprocta	*Bugula neritina*	Bugulidae	Mediterranean and southern Europe
Entoprocta	*Bugula stolonifera*	Bugulidae	Europe
Entoprocta	*Buskia nitens*	Buskiidae	European seas
Entoprocta	*Celloporaria* sp. 1	Lepraliellidae	?
Entoprocta	*Conopeum seurati*	Electridae	Caspian Sea, Sea of Azov, Mediterranean, North Africa
Entoprocta	*Cryptosula pallasiana*	Cryptosulidae	Cosmopolitan
Entoprocta	*Electra tenella*	Electridae	Atlantic coast of Florida, Puerto Rico, Brazil
Entoprocta	*Tricellaria porteri*	Candidae	Southern Australia or Japan, now cosmopolitan
Entoprocta	*Watersipora arcuata*	Watersiporidae	California to Galapagos Islands
Entoprocta	*Watersipora subtorquata*	Watersiporidae	Brazil, Bermuda, Cape Verde Islands
Entoprocta	*Zoobotryon verticillatum*	Vesiculariidae	Mediterranean
Isopoda	*Limnoria tripunctata*	Limnoriidae	Cosmopolitan warm to tropical waters
Mollusca	*Crassostrea gigas*	Ostreidae	Japan, Korea and vicinity (adventive: Pacific & Atlantic coast of North America, Hawaii, Okinawa, New South Wales)
Mollusca	*Cuthona alpha*	Tergipediidae	Japan (adventive: Pacific coast North America)
Mollusca	*Cuthona beta*	Tergipediidae	Japan
Mollusca	*Eubranchus agrius*	Eubranchidae	Chile
Mollusca	*Limaria orientalis*	Limidae	Japan, Philippines & widely distributed in Indo Pacific
Mollusca	*Lyrodus mediolobatus*	Teredinidae	Tropical cosmopolitan
Mollusca	*Lyrodus pedicellatus*	Teredinidae	Tropical to temperate seas, cosmopolitan
Mollusca	*Microtralia* sp.= M. *insularis*	Ellobiidae	Unknown
Mollusca	*Musculista senhousia*	Mytilidae	Eastern Asia from Singapore to Siberia
Mollusca	*Okenia pellucida*	Goniodorididae	Australia
Mollusca	*Okenia plana*	Goniodorididae	Cosmopolitan
Mollusca	*Polycera hedgpethi*	Polyceridae	Unknown, now almost cosmopolitan
Mollusca	*Thecacera pennigera*	Polyceridae	Unknown; temperate cosmopolitan (perhaps originally temperate latitude of eastern South America)
Mollusca	*Theora lubrica*	Semelidae	Japan, the tropical Pacific, Indonesia, Thailand, China Philippines and Australia

Taxon	Species	Family	Probable native range
Polychaeta	*Ficopomatus enigmaticus*	Serpulidae	Obscure, European coastal waters
Polychaeta	*Hydroides elegans*	Serpulidae	Unknown, now cosmopolitan
Polychaeta	*Hydroides ezoensis*	Serpulidae	Japan (adventive in northeast Atlantic, Australia)
Polychaeta	*Polydora cornuta*	Spionidae	Atlantic Coast North America European coastal waters
Polychaeta	*Polydora haswelli*	Spionidae	Australia
Polychaeta	*Pseudopolydora corniculata*	Spionidae	Taiwan
Polychaeta	*Chaetopterus* sp. A	Chaetopteridae	Unknown
Porifera	*Clathrina coriacea*	Clathrinidae	North Atlantic, Mediterranean, Japan Indian Ocean, Arctic, Antarctic
Porifera	*Cliona celata*	Clionidae	Arctic, Atlantic coasts of Europe & North America, West Indies, Indian Ocean, Red Sea, Malaysia, Australia, New Guinea
Porifera	*Dendya poterium*	Clathrinidae	Europe, circumglobal
Porifera	*Halichondria panicea*	Halichondriidae	Europe, cosmopolitan
Porifera	*Halisarca dujardini*	Halisarcidae	Europe, cosmopolitan
Porifera	*Hymeniacidon perleve*	Hymeniacidonidae	Europe, cosmopolitan
Porifera	*Tethya aurantium*	Tethyidae	California
Porifera	*Haliclona heterofibrosa*	Haliclonidae	North-eastern Atlantic
Porifera	*Plakina monolopha*	Plakinidae	Mediterranean
Protozoa	*Siphogenerina raphanus*	Siphogenerinoididae	Cosmopolitan
Teleostei	*Acentrogobius pflaumii*	Gobiidae	Japan, Korea, Taiwan, Philippines (adventive in Australia)
Teleostei	*Arenigobius bifrenatus*	Gobiidae	Southern Australia
Teleostei	*Omobranchus anolius*	Blenniidae	Southern Australia

10.4 Appendix 4: Sediment characteristics

Particle size as gravimetric %, %organics calculated from loss on ignition, and chlorophyll *a* (chla). June 2004 samples were lost prior to analysis.

site	date	%clay	%silt	%mud	%fine sand	% medium	%coarse sand	%gravel	%organics	chla υg/g
HBV	Oct-00	0.48	7.65	8.13	74.16	12.20	4.01	1.50	0.95	10.26
	Dec-00	0.05	5.17	5.22	78.45	10.74	2.33	3.26	1.05	13.36
	Feb-01	1.08	4.41	5.49	75.11	14.43	2.88	2.09	1.16	13.62
	Apr-01	1.8	4.84	6.64	66.93	18.26	4.97	3.2	1.29	17.77
	Jun-01	1.38	2.59	3.97	67.83	18.27	5.19	4.75	1.18	18.79
	Aug-01	1.20	4.46	5.66	77.59	12.67	2.66	1.43	1.15	17.51
	Oct-01	1.49	3.83	5.32	73.67	14.90	4.02	2.09	0.81	16.50
	Dec-01	1.60	4.42	6.02	71.49	15.98	2.73	3.78	0.80	12.38
	Feb-02	1.80	3.24	5.03	71.49	13.79	4.96	4.72	1.67	11.21
	Apr-02	0.85	1.02	1.88	46.32	45.28	5.92	0.60	1.14	17.18
	Jun-02	0.69	0.69	1.38	48.61	42.09	5.58	2.34	1.17	18.09
	Aug-02	0.32	0.49	0.81	46.19	40.48	9.45	3.07	2.43	15.80
	Oct-02	0.50	1.49	1.99	54.79	31.31	8.15	3.75	3.73	13.98
	Dec-02	1.60	0.27	1.86	58.28	32.23	4.65	2.97	1.25	12.58
	Feb-03	1.70	1.06	2.76	53.54	31.54	8.33	3.82	1.12	12.20
	Apr-03	0.00	2.05	2.05	55.95	33.42	7.65	0.92	1.39	17.75
	Jun-03	1.05	1.05	2.10	56.44	24.44	13.32	3.69	1.17	10.76
	Aug-03	0.00	1.29	1.29	60.15	31.61	6.09	0.86	0.78	11.24
	Oct-03	0.78	0.78	1.55	50.07	39.00	7.84	1.53	0.78	7.97
	Dec-03	0.00	1.50	1.50	47.68	43.56	7.09	0.17	0.83	14.11
	Feb-04	0.00	1.85	1.85	59.54	31.24	5.70	1.67	1.11	12.83
	Apr-04	0.00	2.67	2.67	49.60	32.00	5.75	9.98	3.38	11.23
	Jun-04									7.98
	Aug-04	2.32	1.55	3.87	56.69	33.33	6.10	0.00	0.52	18.04
	Oct-04	1.97	0.98	2.95	52.05	25.78	5.87	13.36	1.75	10.78
	Dec-04	2.40	0.00	2.40	48.99	39.52	8.70	0.38	2.19	15.36
	Feb-05	2.55	1.28	3.83	56.71	32.41	6.53	0.52	6.40	10.39
	Apr-05	1.30	2.59	3.89	49.48	33.58	7.08	5.97	1.07	12.66
	Jun-05	2.25	2.25	4.50	54.52	33.01	7.30	0.67	1.29	16.24
	Aug-05	2.46	0.99	3.45	56.32	34.15	5.67	0.41	1.12	15.32
	Oct-05	1.65	0.47	2.12	54.51	36.31	6.86	0.20	1.53	17.55
	Dec-05	0.98	0.00	0.98	44.21	42.33	10.71	1.76	1.75	10.68
	Feb-06	1.61	1.61	3.22	63.63	36.18	6.78	0.18	1.87	11.00
HC	Oct-00	0.43	3.57	4.00	55.08	23.92	9.36	7.64	1.61	9.53
	Dec-00	0.5	1.31	1.81	48.81	40.02	7.77	1.59	1.89	19.89
	Feb-01	0.45	1.92	2.37	50.99	37.74	8.05	0.85	1.75	17.99
	Apr-01	0.17	1.26	1.43	55.75	26.83	5.08	10.9	2.66	26.12
	Jun-01	0.57	1.47	2.04	58.03	31.22	7.96	0.74	2.65	29.61
	Aug-01	0.49	2.97	3.46	67.19	22.95	5.19	1.20	1.50	18.89

site	date	%clay	%silt	%mud	%fine sand	% medium	%coarse sand	%gravel	%organics	chla υg/g
	Oct-01	0.53	1.76	2.30	58.56	30.63	7.43	1.08	1.46	21.67
	Dec-01	0.37	1.80	2.17	47.88	35.95	7.65	6.34	1.10	23.60
	Feb-02	0.13	3.53	3.66	52.76	25.84	11.42	6.33	2.55	16.58
	Apr-02	0.00	4.40	4.40	75.51	13.56	5.00	1.53	2.11	29.57
	Jun-02	3.15	0.00	3.15	74.86	15.05	3.82	3.12	2.08	26.77
	Aug-02	0.48	2.09	2.57	66.94	23.80	4.61	2.09	2.32	22.11
	Oct-02	3.73	2.66	6.39	75.07	13.30	3.24	2.00	2.04	22.49
	Dec-02	3.25	3.25	6.49	64.35	12.43	2.39	14.33	1.80	26.04
	Feb-03	2.51	3.35	5.86	72.52	13.85	4.06	3.70	1.77	29.99
	Apr-03	4.23	2.82	7.05	69.26	15.36	3.74	4.58	0.85	23.38
	Jun-03	3.78	1.89	5.67	35.11	52.55	3.16	3.50	1.19	31.70
	Aug-03	2.85	0.95	3.81	75.80	15.16	4.10	1.13	1.47	27.98
	Oct-03	0.83	5.42	6.26	77.57	12.42	2.70	1.05	1.90	20.34
	Dec-03	4.62	3.85	8.47	74.10	13.75	2.24	1.44	1.81	16.53
	Feb-04	3.13	4.70	7.83	74.91	12.75	3.05	1.46	1.92	23.81
	Apr-04	3.67	5.50	9.17	74.96	12.51	1.97	1.39	0.89	27.98
	Jun-04									18.80
	Aug-04	5.11	1.28	6.38	73.89	12.39	5.31	2.02	0.34	24.09
	Oct-04	4.62	2.77	7.39	71.92	17.67	3.03	0.00	2.85	19.92
	Dec-04	8.98	1.28	10.26	72.81	12.12	3.44	1.38	3.62	38.62
	Feb-05	2.67	4.46	7.13	75.56	12.19	2.51	2.60	4.74	37.79
	Apr-05	3.96	5.28	9.23	74.70	12.55	2.84	0.67	3.00	31.27
	Jun-05	3.93	1.57	5.50	77.36	13.39	3.25	0.50	2.37	25.63
	Aug-05	5.65	1.13	6.78	72.12	13.48	5.20	2.42	2.21	32.94
	Oct-05	5.21	4.26	9.47	77.16	10.86	2.01	0.49	2.24	18.41
	Dec-05	4.46	0.74	5.20	77.40	11.77	3.55	2.07	3.34	27.47
	Feb-06	0.47	5.64	6.11	76.45	14.29	2.44	0.72	2.18	16.28
Reef	Oct-00	0.59	3.50	4.09	91.80	3.77	0.28	0.06	0.90	7.28
	Dec-00	1.12	3.25	4.37	93.12	1.79	0.29	0.43	0.92	11.12
	Feb-01	1.17	4.22	5.39	90.81	2.78	0.18	0.85	1.09	10.51
	Apr-01	0.24	3.02	3.26	92.07	3.24	0.23	1.2	1.13	12.74
	Jun-01	1.04	3.87	4.91	91.43	2.78	0.19	0.68	1.26	15.02
	Aug-01	0.91	5.28	6.19	87.22	5.02	0.14	1.43	1.16	10.94
	Oct-01	0.67	2.76	3.43	89.44	5.21	0.26	1.67	0.74	10.54
	Dec-01	1.39	1.81	3.20	93.76	2.87	0.11	0.06	1.35	6.29
	Feb-02	0.32	2.58	2.90	87.20	8.37	0.92	0.62	1.02	19.31
	Apr-02	2.13	1.83	3.96	92.37	3.25	0.17	0.25	1.52	17.64
	Jun-02	1.98	3.30	5.27	91.51	3.11	0.10	0.00	1.14	12.65
	Aug-02	3.11	4.36	7.47	89.26	3.00	0.23	0.04	1.62	15.64
	Oct-02	3.63	1.45	5.08	92.25	1.67	0.11	0.89	1.04	10.46
	Dec-02	1.85	2.16	4.01	93.73	1.27	0.24	0.75	2.01	10.03
	Feb-03	1.91	1.91	3.82	93.32	2.56	0.19	0.12	1.13	7.24
	Apr-03	1.86	1.60	3.46	91.96	3.72	0.36	0.50	1.00	9.60
	Jun-03	0.94	4.72	5.67	87.22	7.11	0.00	0.00	2.00	11.92
	Aug-03	7.65	0.00	7.65	89.41	2.59	0.27	0.07	0.99	8.47
	Oct-03	2.70	4.04	6.74	90.29	2.59	0.27	0.12	1.08	6.42

site	date	%clay	%silt	%mud	%fine sand	% medium	%coarse sand	%gravel	%organics	chla υg/g
	Dec-03	0.79	8.65	9.44	88.41	2.08	0.07	0.00	1.09	6.52
	Feb-04	1.55	6.19	7.74	89.12	2.97	0.11	0.06	1.24	6.74
	Apr-04	2.12	3.18	5.30	90.98	3.36	0.19	0.16	7.22	7.37
	Jun-04									8.69
	Aug-04	6.12	1.53	7.65	86.56	2.84	0.55	2.40	0.50	9.90
	Oct-04	4.85	1.62	6.47	91.82	1.67	0.04	0.00	1.20	5.36
	Dec-04	2.59	0.43	3.02	94.55	2.26	0.06	0.12	2.16	10.99
	Feb-05	3.67	0.00	3.67	94.85	1.15	0.29	0.04	1.78	7.91
	Apr-05	3.56	4.57	8.13	89.85	1.90	0.00	0.13	1.68	7.83
	Jun-05	4.04	2.69	6.74	87.26	3.93	0.27	1.81	1.28	6.76
	Aug-05	4.45	5.56	10.01	87.09	2.53	0.28	0.10	1.48	10.39
	Oct-05	2.65	4.97	7.61	90.31	1.90	0.11	0.07	1.64	18.45
	Dec-05	3.60	6.40	10.00	87.81	2.03	0.11	0.06	1.93	6.40
	Feb-06	3.00	3.85	6.85	91.58	1.32	0.23	0.02	1.43	7.93
ShB	Oct-00	0.13	3.33	3.46	78.71	14.11	2.46	1.26	0.63	5.23
	Dec-00	0.42	1.74	2.16	68.32	24.91	1.96	2.65	0.64	8.78
	Feb-01	0.46	1.27	1.73	67.55	28.84	0.87	1.01	0.27	4.87
	Apr-01	0.09	1.59	1.68	74.45	21.83	0.64	1.41	0.91	7.04
	Jun-01	0.37	1.17	1.54	72.98	22.83	1.31	1.35	0.49	10.29
	Aug-01	0.77	2.24	3.00	71.78	20.01	1.57	3.64	0.54	7.03
	Oct-01	12.36	0.65	13.01	63.30	22.43	0.70	0.56	0.48	10.72
	Dec-01	0.96	0.67	1.63	62.87	20.93	0.55	14.01	1.05	11.10
	Feb-02	0.68	2.91	3.59	78.72	15.86	1.08	0.76	0.76	10.53
	Apr-02	0.19	1.31	1.49	77.08	17.17	1.90	2.36	0.62	10.03
	Jun-02	0.50	1.66	2.15	67.64	25.86	2.01	2.34	0.73	8.19
	Aug-02	2.34	0.00	2.34	67.51	25.94	2.72	1.50	0.69	10.67
	Oct-02	2.80	0.25	3.06	80.84	11.70	3.33	1.07	0.81	7.79
	Dec-02	0.47	0.10	0.58	60.27	25.83	8.71	4.61	0.84	8.48
	Feb-03	0.18	0.55	0.74	53.62	37.54	5.03	3.07	0.23	6.45
	Apr-03	0.00	1.56	1.56	69.27	23.72	2.63	2.82	0.51	6.63
	Jun-03	0.00	1.89	1.89	48.92	41.65	1.68	5.86	0.70	8.38
	Aug-03	1.36	0.82	2.18	76.41	9.37	1.37	10.68	0.80	6.37
	Oct-03	0.36	2.89	3.25	79.66	12.31	2.13	2.65	0.92	6.87
	Dec-03	0.00	2.44	2.44	75.61	14.59	1.76	5.59	0.87	5.62
	Feb-04	0.00	3.33	3.33	69.35	14.13	3.97	9.21	0.84	5.05
	Apr-04	0.00	7.35	7.35	83.55	8.02	0.41	0.66	0.42	2.77
	Jun-04									13.56
	Aug-04	3.18	3.18	6.37	73.68	9.39	4.58	5.98	0.54	8.08
	Oct-04	0.83	0.83	1.67	72.67	24.18	0.77	0.71	0.87	8.37
	Dec-04	1.98	0.00	1.98	77.59	10.56	2.69	7.19	1.36	6.53
	Feb-05	0.00	3.20	3.20	85.28	10.82	0.59	0.12	1.94	7.99
	Apr-05	3.08	2.55	5.63	87.08	4.75	0.66	1.88	1.23	6.75
	Jun-05	2.69	1.35	4.04	75.08	7.57	2.87	10.44	0.96	5.04
	Aug-05	2.65	0.44	3.09	74.20	11.95	4.48	6.28	0.78	6.81
	Oct-05	2.23	2.60	4.83	84.69	8.11	0.87	1.50	1.01	14.32
	Dec-05	1.02	0.00	1.02	85.13	12.27	0.80	0.78	0.68	6.64
	Feb-06	5.85	0.49	6.33	86.11	3.79	0.53	3.23	0.71	4.23

site	date	%clay	%silt	%mud	%fine sand	%medium sand	%coarse sand	%gravel	%organics	chla υg/g
Whau	Oct-00	0.02	2.75	2.77	93.64	1.79	0.80	1.00	0.76	5.23
	Dec-00	0.26	1.96	2.22	92.38	3.04	0.82	1.53	0.77	8.78
	Feb-01	0.7	2.11	2.81	91.9	2.4	0.69	2.19	0.86	4.87
	Apr-01	0.02	3.17	3.19	82.15	14.23	0.26	0.16	1.42	7.04
	Jun-01	0.57	1.67	2.24	88.91	3.37	0.64	4.84	1.02	10.29
	Aug-01	0.85	1.84	2.69	94.48	1.81	0.65	0.36	0.90	7.03
	Oct-01	0.85	1.90	2.75	92.42	2.78	0.47	1.59	0.86	10.72
	Dec-01	0.53	1.38	1.91	91.65	1.10	0.34	5.00	2.86	11.10
	Feb-02	0.41	2.00	2.41	90.94	4.59	0.81	1.24	1.03	10.53
	Apr-02	1.06	1.06	2.12	95.48	1.29	0.43	0.68	0.93	10.03
	Jun-02	0.00	1.81	1.81	91.37	5.18	0.75	0.89	1.09	8.19
	Aug-02	0.00	1.81	1.81	92.44	2.49	0.54	2.72	1.07	10.67
	Oct-02	0.99	2.31	3.30	91.71	3.79	0.56	0.64	0.75	7.79
	Dec-02	1.70	0.57	2.26	94.94	1.57	0.49	0.73	0.58	8.48
	Feb-03	2.50	1.59	4.10	88.20	4.67	0.91	2.12	0.76	6.45
	Apr-03	0.80	2.41	3.21	92.25	2.19	0.52	1.83	0.80	6.63
	Jun-03	1.76	1.76	3.52	92.20	3.16	0.65	0.47	0.85	8.38
	Aug-03	1.91	0.00	1.91	95.10	1.98	0.59	0.42	0.80	6.37
	Oct-03	1.46	1.46	2.92	93.55	2.24	0.66	0.64	0.92	6.87
	Dec-03	0.80	4.01	4.81	91.87	2.09	0.35	0.89	0.87	5.62
	Feb-04	0.86	4.30	5.16	92.29	1.20	0.50	0.85	0.84	5.05
	Apr-04	0.00	5.10	5.10	93.48	0.97	0.45	0.00	0.58	8.72
	Jun-04									10.02
	Aug-04	2.00	1.33	3.33	94.22	1.51	0.88	0.05	0.16	13.28
	Oct-04	1.47	0.59	2.06	93.08	1.07	0.39	3.40	1.17	11.22
	Dec-04	1.33	2.65	3.98	93.68	1.55	0.80	0.00	2.03	11.79
	Feb-05	0.00	1.62	1.62	93.95	1.22	0.73	2.48	1.58	10.13
	Apr-05	1.94	3.23	5.16	88.73	1.26	0.60	4.24	1.28	7.36
	Jun-05	3.52	0.59	4.10	93.07	0.89	0.58	1.35	1.02	9.77
	Aug-05	2.74	2.19	4.93	91.40	1.37	0.71	1.59	0.63	12.94
	Oct-05	1.05	2.10	3.15	92.89	1.40	0.90	1.67	1.01	12.41
	Dec-05	1.54	0.00	1.54	96.07	1.22	0.42	0.75	1.19	7.19
	Feb-06	1.10	0.74	1.84	95.69	0.83	0.54	1.09	0.84	10.60

10.5 Appendix 5: Benthic Invertebrate data collected between October 2000 and February 2006.

Total, median, mean number of individuals found in 12 cores. Range= 90th percentile – 5th percentile.

Species: *Anthopleura aureoradiata*

Site	Series	Total	Median	Range	Mean
HBV	1	14	1	3	1.2
HBV	2	16	1	4	1.3
HBV	3	0	0	0	0.0
HBV	4	21	2	4	1.8
HBV	5	23	1.5	3	1.9
HBV	6	13	1	3	1.1
HBV	7	17	1	3	1.4
HBV	8	18	1	4	1.5
HBV	9	56	3	11	4.7
HBV	10	21	1	4	1.8
HBV	11	17	1	3	1.4
HBV	12	30	3	4	2.5
HBV	13	18	1	3	1.5
HBV	14	39	3	4	3.3
HBV	15	47	3	8	3.9
HBV	16	17	1.5	3	1.4
HBV	17	20	1	5	1.7
HBV	18	13	1	3	1.1
HBV	19	22	1.5	4	1.8
HBV	20	30	3	3	2.5
HBV	21	18	1	4	1.5
HBV	22	26	2	5	2.2
HBV	23	24	1.5	5	2.0
HBV	24	34	2	5	2.8
HBV	25	24	2	3	2.0
HBV	26	58	5	8	4.8
HBV	27	57	3.5	11	4.8
HBV	28	50	4	8	4.2
HBV	29	37	3	5	3.1
HBV	30	24	1.5	3	2.0
HBV	31	31	2	7	2.6
HBV	32	43	3	8	3.6
HBV	33	30	2.5	5	2.5
HC	1	36	3	4	3.0
HC	2	17	1	3	1.4
HC	3	31	2	5	2.6
HC	4	22	1.5	4	1.8
HC	5	31	2.5	5	2.6
HC	6	26	2	4	2.2
HC	7	23	2	3	1.9
HC	8	25	1.5	4	2.1
HC	9	21	1	5	1.8
HC	10	19	1	3	1.6
HC	11	19	1.5	3	1.6
HC	12	28	2	4	2.4
HC	13	19	1.5	4	1.6
HC	14	22	1.5	2.5	1.9
HC	15	24	1.5	4	2.0
HC	16	28	2.5	4	2.3
HC	17	20	1.5	3	1.7
HC	18	26	2	3	2.2
HC	19	36	3	5	3.0
HC	20	56	4.5	7	4.7
HC	21	31	2	6	2.6
HC	22	44	3.5	7	3.7
HC	23	39	2	8	3.3

Site	Series	Total	Median	Range	Mean
HC	24	21	1	5	1.8
HC	25	33	2.5	5	2.8
HC	26	41	3	7	3.4
HC	27	58	4.5	8	4.8
HC	28	55	4	8	4.6
HC	29	45	3	5	3.8
HC	30	57	4	6	4.8
HC	31	44	3	8	3.7
HC	32	40	2.5	7	3.3
HC	33	44	4	5	3.7
Reef	1	0	0	0	0.0
Reef	2	1	0	0	0.1
Reef	3	0	0	0	0.0
Reef	4	1	0	0	0.1
Reef	5	0	0	0	0.0
Reef	6	1	0	0	0.1
Reef	7	0	0	0	0.0
Reef	8	2	0	1	0.2
Reef	9	2	0	1	0.2
Reef	10	0	0	0	0.0
Reef	11	1	0	0	0.1
Reef	12	0	0	0	0.0
Reef	13	0	0	0	0.0
Reef	14	0	0	0	0.0
Reef	15	0	0	0	0.0
Reef	16	0	0	0	0.0
Reef	17	2	0	0	0.2
Reef	18	0	0	0	0.0
Reef	19	1	0	0	0.1
Reef	20	0	0	0	0.0
Reef	21	0	0	0	0.0
Reef	22	0	0	0	0.0
Reef	23	0	0	0	0.0
Reef	24	0	0	0	0.0
Reef	25	0	0	0	0.0
Reef	26	0	0	0	0.0
Reef	27	0	0	0	0.0
Reef	28	0	0	0	0.0
Reef	29	0	0	0	0.0
Reef	30	2	0	0	0.2
Reef	31	0	0	0	0.0
Reef	32	0	0	0	0.0
Reef	33	0	0	0	0.0
ShB	1	9	0	2	0.8
ShB	2	10	0	2	0.8
ShB	3	9	0	2	0.8
ShB	4	15	1	3	1.3
ShB	5	6	0	2	0.5
ShB	6	5	0	1	0.4
ShB	7	10	1	2	0.8
ShB	8	8	0	2	0.7
ShB	9	5	0	1	0.4
ShB	10	6	0	2	0.5
ShB	11	7	0.5	1	0.6
ShB	12	4	0	1	0.4
ShB	13	5	0	1	0.4
ShB	14	9	0	2	0.8
ShB	15	14	0.5	2	1.2

Species: *Anthopleura aureoradiata* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	11	0	3	0.9
ShB	17	12	0.5	3	1.0
ShB	18	15	1	3	1.3
ShB	19	11	0	3	0.9
ShB	20	13	0.5	3	1.1
ShB	21	9	0	3	0.8
ShB	22	13	1	3	1.1
ShB	23	4	0	1	0.3
ShB	24	5	0	1	0.4
ShB	25	4	0	1	0.3
ShB	26	4	0	1	0.3
ShB	27	6	0	2	0.5
ShB	28	8	0	2	0.7
ShB	29	9	0	3	0.8
ShB	30	13	0.5	3	1.1
ShB	31	14	0	4	1.2
ShB	32	3	0	1	0.3
ShB	33	13	1	3	1.1
Whau	1	20	0	5	1.7
Whau	2	19	1	3	1.6
Whau	3	26	1	5	2.2
Whau	4	30	2	6	2.5
Whau	5	19	2	4	1.6
Whau	6	14	1	3	1.2
Whau	7	14	1	2	1.2
Whau	8	20	1.5	3	1.7
Whau	9	22	2	4	1.8
Whau	10	17	1	4	1.4
Whau	11	6	0	1	0.5
Whau	12	6	0	1	0.5
Whau	13	5	0	1	0.4
Whau	14	15	1	3	1.3
Whau	15	11	1	2	0.9
Whau	16	5	0	1	0.4
Whau	17	10	0	2	0.8
Whau	18	7	0	2	0.6
Whau	19	4	0	1	0.3
Whau	20	14	1	3	1.2
Whau	21	11	1	2	0.9
Whau	22	9	1	2	0.8
Whau	23	0	0	0	0.0
Whau	24	15	1.5	3	1.3
Whau	25	10	0.5	3	0.8
Whau	26	14	0.5	3	1.2
Whau	27	5	0	1	0.4
Whau	28	14	1	2	1.2
Whau	29	8	0.5	2	0.7
Whau	30	10	1	2	0.8
Whau	31	3	0	1	0.3
Whau	32	10	1	2	0.8
Whau	33	9	1	2	0.8

Species: *Aonides oxycephala*

Site	Series	Total	Median	Range	Mean
HBV	1	149	11	20	12.5
HBV	2	160	12.5	23	13.3
HBV	3	294	22.5	30	24.5
HBV	4	313	24	14	26.1
HBV	5	227	19.5	30	18.9
HBV	6	235	16	26	19.6
HBV	7	366	31	23	30.5
HBV	8	356	29	29	29.7
HBV	9	126	9.5	14	10.5
HBV	10	351	31	46	29.3
HBV	11	248	19	20	20.7
HBV	12	312	27	35	26.0
HBV	13	236	20.5	19	19.7
HBV	14	235	17	10	19.6
HBV	15	343	26.5	34	28.6
HBV	16	242	21	22	20.2
HBV	17	130	11.5	12	10.8
HBV	18	228	17.5	23	19.0
HBV	19	292	24.5	27	24.3
HBV	20	188	16.5	18	15.7
HBV	21	173	14.5	17	14.4
HBV	22	223	16.5	14	18.6
HBV	23	188	15.5	23	15.7
HBV	24	241	19	25	20.1
HBV	25	248	20.5	33	20.7
HBV	26	348	24.5	26	29.0
HBV	27	254	22.5	27	21.2
HBV	28	275	21.5	33	22.9
HBV	29	307	25	17	25.6
HBV	30	255	22	16	21.3
HBV	31	323	22	37	26.9
HBV	32	228	21.5	30	19.0
HBV	33	280	19.5	30	23.3
HC	1	2	0	1	0.2
HC	2	2	0	1	0.2
HC	3	4	0	1	0.3
HC	4	0	0	0	0.0
HC	5	2	0	1	0.2
HC	6	11	0	3	0.9
HC	7	0	0	0	0.0
HC	8	3	0	1	0.3
HC	9	0	0	0	0.0
HC	10	10	0	2	0.8
HC	11	1	0	0	0.1
HC	12	3	0	1	0.3
HC	13	0	0	0	0.0
HC	14	2	0	1	0.2
HC	15	0	0	0	0.0
HC	16	1	0	0	0.1
HC	17	0	0	0	0.0
HC	18	5	0	2	0.4
HC	19	0	0	0	0.0
HC	20	1	0	0	0.1
HC	21	1	0	0	0.1
HC	22	1	0	0	0.1
HC	23	0	0	0	0.0

Site	Series	Total	Median	Range	Mean
HC	24	3	0	1	0.3
HC	25	1	0	0	0.1
HC	26	5	0	1	0.4
HC	27	2	0	1	0.2
HC	28	0	0	0	0.0
HC	29	1	0	0	0.1
HC	30	0	0	0	0.0
HC	31	0	0	0	0.0
HC	32	3	0	1	0.3
HC	33	0	0	0	0.0
Reef	1	1	0	0	0.1
Reef	2	3	0	1	0.3
Reef	3	2	0	1	0.2
Reef	4	1	0	0	0.1
Reef	5	0	0	0	0.0
Reef	6	0	0	0	0.0
Reef	7	1	0	0	0.1
Reef	8	2	0	1	0.2
Reef	9	0	0	0	0.0
Reef	10	0	0	0	0.0
Reef	11	0	0	0	0.0
Reef	12	1	0	0	0.1
Reef	13	0	0	0	0.0
Reef	14	0	0	0	0.0
Reef	15	0	0	0	0.0
Reef	16	0	0	0	0.0
Reef	17	2	0	1	0.2
Reef	18	4	0	1	0.3
Reef	19	0	0	0	0.0
Reef	20	0	0	0	0.0
Reef	21	0	0	0	0.0
Reef	22	1	0	0	0.1
Reef	23	0	0	0	0
Reef	24	8	0	2	0.7
Reef	25	1	0	0	0.1
Reef	26	1	0	0	0.1
Reef	27	2	0	1	0.2
Reef	28	5	0	2	0.4
Reef	29	3	0	1	0.3
Reef	30	1	0	0	0.1
Reef	31	0	0	0	0.0
Reef	32	1	0	0	0.1
Reef	33	1	0	0	0.1
ShB	1	6	0	1	0.5
ShB	2	6	0	1	0.5
ShB	3	7	0	2	0.6
ShB	4	27	0	13	2.3
ShB	5	24	0	2	2.0
ShB	6	21	0	4	1.8
ShB	7	0	0	0	0.0
ShB	8	5	0	2	0.4
ShB	9	1	0	0	0.1
ShB	10	28	0	2	2.3
ShB	11	2	0	0	0.2
ShB	12	26	0	6	2.2
ShB	13	2	0	1	0.2
ShB	14	58	1	33	4.9
ShB	15	56	0	24	4.7

Species: *Aonides oxycephala cont.*

Site	Series	Total	Median	Range	Mean
ShB	16	11	0	3	0.9
ShB	17	6	0	2	0.5
ShB	18	1	0	0	0.1
ShB	19	9	0.5	2	0.8
ShB	20	24	0	1	2.0
ShB	21	0	0	0	0.0
ShB	22	4	0	1	0.3
ShB	23	9	0	1	0.8
ShB	24	19	1	3	1.6
ShB	25	9	0	3	0.8
ShB	26	13	0	6	1.1
ShB	27	14	0	0	1.2
ShB	28	12	1	2	1.0
ShB	29	11	0	2	0.9
ShB	30	8	0	2	0.7
ShB	31	22	0	3	1.8
ShB	32	6	0	1	0.5
ShB	33	12	0	2	1.0
Whau	1	2	0	1	0.2
Whau	2	1	0	0	0.1
Whau	3	1	0	0	0.1
Whau	4	70	6	10	5.9
Whau	5	7	0	1	0.6
Whau	6	1	0	0	0.1
Whau	7	0	0	0	0.0
Whau	8	2	0	1	0.2
Whau	9	2	0	0	0.2
Whau	10	6	0	2	0.5
Whau	11	1	0	0	0.1
Whau	12	0	0	0	0.0
Whau	13	7	1	1	0.6
Whau	14	2	0	1	0.2
Whau	15	3	0	1	0.3
Whau	16	2	0	1	0.2
Whau	17	0	0	0	0.0
Whau	18	6	0	2	0.5
Whau	19	0	0	0	0.0
Whau	20	0	0	0	0.0
Whau	21	3	0	1	0.3
Whau	22	9	0	3	0.8
Whau	23	6	0	1	0.5
Whau	24	13	1	2	1.1
Whau	25	11	0.5	2	0.9
Whau	26	19	1	6	1.6
Whau	27	20	0.5	5	1.7
Whau	28	17	0	5	1.4
Whau	29	5	0	1	0.4
Whau	30	21	0	5	1.8
Whau	31	21	1	4	1.8
Whau	32	6	0	2	0.5
Whau	33	4	0	1	0.3

Species: *Aquilaspio aucklandica*

Site	Series	Total	Median	Range	Mean
HBV	1	46	3	9	3.9
HBV	2	53	2.5	9	4.4
HBV	3	111	8	12	9.3
HBV	4	140	11.5	18	11.7
HBV	5	104	7.5	17	8.7
HBV	6	112	6.5	27	9.3
HBV	7	108	7	16	9.0
HBV	8	71	5	8	5.9
HBV	9	86	7.5	14	7.2
HBV	10	93	7	10	7.8
HBV	11	72	6	9	6.0
HBV	12	66	4.5	9.5	5.5
HBV	13	75	5.5	9	6.3
HBV	14	76	6	10	6.4
HBV	15	64	5	11	5.3
HBV	16	61	4.5	7	5.1
HBV	17	39	2.5	6	3.3
HBV	18	59	5	7	4.9
HBV	19	42	3	7	3.5
HBV	20	51	3.5	5	4.3
HBV	21	48	2.5	10	4.0
HBV	22	48	4.5	6	4.0
HBV	23	35	2.5	6	2.9
HBV	24	34	1.5	7	2.8
HBV	25	38	3	7	3.2
HBV	26	40	3	5	3.3
HBV	27	42	2.5	8	3.5
HBV	28	43	3	6	3.6
HBV	29	41	2	6	3.4
HBV	30	29	2	3	2.4
HBV	31	32	2.5	3	2.7
HBV	32	16	1	3	1.3
HBV	33	35	3.5	5	2.9
HC	1	64	4.5	11	5.3
HC	2	36	1.5	7	3.0
HC	3	71	5.5	13	5.9
HC	4	111	7	9	9.3
HC	5	69	5.5	8	5.8
HC	6	142	9.5	24	11.8
HC	7	74	4	12	6.2
HC	8	45	3	5	3.8
HC	9	72	4.5	12	6.0
HC	10	36	1.5	9	3.0
HC	11	53	4	10	4.4
HC	12	46	4	7	3.9
HC	13	41	2	5	3.4
HC	14	49	4.5	5.5	4.1
HC	15	37	2	7	3.1
HC	16	36	2.5	5	3.0
HC	17	20	1.5	3	1.7
HC	18	40	3	6	3.3
HC	19	34	3.5	4	2.8
HC	20	37	3	5	3.1
HC	21	22	1	5	1.8
HC	22	37	4	4	3.1
HC	23	27	1.5	5	2.3

Site	Series	Total	Median	Range	Mean
HC	24	30	2	4	2.5
HC	25	10	1	2	0.8
HC	26	13	1	3	1.1
HC	27	7	0	2	0.6
HC	28	14	1	3	1.2
HC	29	8	1	1	0.7
HC	30	10	0.5	2	0.8
HC	31	14	1	3	1.2
HC	32	9	0	2	0.8
HC	33	17	2	3	1.4
Reef	1	7	0.5	1	0.6
Reef	2	17	1	3	1.4
Reef	3	25	2	4	2.1
Reef	4	28	2	5	2.3
Reef	5	19	1	3	1.6
Reef	6	30	3	6	2.5
Reef	7	31	3	4	2.6
Reef	8	17	1	5	1.4
Reef	9	31	3	4	2.6
Reef	10	9	1	2	0.8
Reef	11	24	2	4	2.0
Reef	12	9	1	2	0.8
Reef	13	22	2	3	1.8
Reef	14	6	0	2	0.5
Reef	15	23	1	6	1.9
Reef	16	22	1	5	1.8
Reef	17	19	2	3	1.6
Reef	18	0	0	0	0.0
Reef	19	17	1	3	1.4
Reef	20	67	5	10	5.6
Reef	21	76	7.5	7	6.3
Reef	22	71	4.5	13	5.9
Reef	23	78	6	11	6.5
Reef	24	64	4.5	10	5.3
Reef	25	39	2.5	5	3.3
Reef	26	39	3	5	3.3
Reef	27	11	0.5	2	0.9
Reef	28	53	4	7	4.4
Reef	29	18	1	3	1.5
Reef	30	32	2.5	5	2.7
Reef	31	40	3	6	3.3
Reef	32	24	2	3	2.0
Reef	33	33	3	3	2.8
ShB	1	4	0	1	0.3
ShB	2	5	0	1	0.4
ShB	3	10	0	3	0.8
ShB	4	21	0	6	1.8
ShB	5	7	0	1	0.6
ShB	6	11	0	2	0.9
ShB	7	9	0	3	0.8
ShB	8	6	0	1	0.5
ShB	9	24	1	4	2.0
ShB	10	20	1	3	1.7
ShB	11	27	2	3	2.3
ShB	12	33	1	7	2.8
ShB	13	7	0	2	0.6
ShB	14	6	0	2	0.5
ShB	15	4	0	1	0.3

Species: *Aquilaspio aucklandica*

Site	Series	Total	Median	Range	Mean
ShB	16	22	1.5	4	1.8
ShB	17	29	2	4	2.4
ShB	18	29	2	5	2.4
ShB	19	26	1	6	2.2
ShB	20	27	0.5	6	2.3
ShB	21	32	2	5	2.7
ShB	22	27	2	5	2.3
ShB	23	81	4.5	16	6.8
ShB	24	54	2.5	13	4.5
ShB	25	16	1	4	1.3
ShB	26	27	1.5	5	2.3
ShB	27	15	1	3	1.3
ShB	28	40	2	6	3.3
ShB	29	31	2.5	5	2.6
ShB	30	29	1	5	2.4
ShB	31	55	3	12	4.6
ShB	32	11	0	3	0.9
ShB	33	18	1.5	3	1.5
Whau	1	46	2	8	3.8
Whau	2	41	3	7	3.4
Whau	3	39	3	7	3.3
Whau	4	76	6	9	6.4
Whau	5	60	5	8	5.0
Whau	6	35	3	4	2.9
Whau	7	42	2.5	7	3.5
Whau	8	16	1	3	1.3
Whau	9	54	4	9	4.5
Whau	10	19	1	3	1.6
Whau	11	20	0.5	6	1.7
Whau	12	25	1	6	2.1
Whau	13	10	0.5	2	0.8
Whau	14	12	0	4	1.0
Whau	15	19	1	3	1.6
Whau	16	15	1	2	1.3
Whau	17	11	1	2	0.9
Whau	18	19	1	4	1.6
Whau	19	8	0	2	0.7
Whau	20	19	1.5	4	1.6
Whau	21	19	1	3	1.6
Whau	22	6	0	2	0.5
Whau	23	1	0	0	0.1
Whau	24	5	0	1	0.4
Whau	25	4	0	1	0.3
Whau	26	3	0	1	0.3
Whau	27	0	0	0	0.0
Whau	28	17	1	3	1.4
Whau	29	6	0	1	0.5
Whau	30	8	0	2	0.7
Whau	31	4	0	1	0.3
Whau	32	4	0	1	0.3
Whau	33	6	0	2	0.5

Species: *Aricidea* sp.

Site	Series	Total	Median	Range	Mean
HBV	1	10	1	3	0.9
HBV	2	1	0	0	0.1
HBV	3	0	0	0	0.0
HBV	4	6	0	1	0.5
HBV	5	3	0	1	0.3
HBV	6	15	0	2	1.3
HBV	7	17	1	3	1.4
HBV	8	10	0	3	0.8
HBV	9	3	0	1	0.3
HBV	10	2	0	1	0.2
HBV	11	8	1	1	0.7
HBV	12	2	0	1	0.2
HBV	13	9	0	3	0.8
HBV	14	1	0	0	0.1
HBV	15	1	0	0	0.1
HBV	16	1	0	0	0.1
HBV	17	2	0	0	0.2
HBV	18	7	0	3	0.6
HBV	19	10	0.5	2	0.8
HBV	20	4	0	1	0.3
HBV	21	1	0	0	0.1
HBV	22	1	0	0	0.1
HBV	23	7	0	1	0.6
HBV	24	19	0	6	1.6
HBV	25	13	0	4	1.1
HBV	26	17	1	4	1.4
HBV	27	5	0	1	0.4
HBV	28	2	0	0	0.2
HBV	29	3	0	1	0.3
HBV	30	7	0	3	0.6
HBV	31	17	1	3	1.4
HBV	32	17	1	3	1.4
HBV	33	2	0	1	0.2
HC	1	124	5.5	22	10.3
HC	2	52	2	11	4.3
HC	3	90	3.5	15	7.5
HC	4	132	7.5	17	11.0
HC	5	230	14	45	19.2
HC	6	7	0	2	0.6
HC	7	219	12	36	18.3
HC	8	121	7	21	10.1
HC	9	124	8	18	10.3
HC	10	23	1	4	1.9
HC	11	76	4	15	6.3
HC	12	86	5	11	7.2
HC	13	132	4	23	11.0
HC	14	92	8	9.5	7.7
HC	15	25	0.5	6	2.1
HC	16	74	5	9	6.2
HC	17	59	2.5	10	4.9
HC	18	152	10	22	12.7
HC	19	154	7	26	12.8
HC	20	147	10	19	12.3
HC	21	67	3.5	7	5.6
HC	22	187	14	20	15.6
HC	23	155	8.5	27	12.9

Site	Series	Total	Median	Range	Mean
HC	24	43	3	8	3.6
HC	25	124	9	17	10.3
HC	26	115	10	18	9.6
HC	27	2	0	1	0.2
HC	28	66	4	12	5.5
HC	29	109	10	16	9.1
HC	30	175	14.5	21	14.6
HC	31	234	14.5	20	19.5
HC	32	140	12	19	11.7
HC	33	127	9.5	17	10.6
Reef	1	33	2.5	6	2.8
Reef	2	59	4	9	4.9
Reef	3	22	2	3	1.8
Reef	4	63	3	10	5.3
Reef	5	51	3	8	4.3
Reef	6	99	8	14	8.3
Reef	7	51	4.5	7	4.3
Reef	8	45	3.5	8	3.8
Reef	9	36	2	6	3.0
Reef	10	9	1	2	0.8
Reef	11	15	1	2	1.3
Reef	12	11	1	1	0.9
Reef	13	42	4	7	3.5
Reef	14	7	0.5	1.5	0.6
Reef	15	17	1.5	3	1.4
Reef	16	35	2.5	7	2.9
Reef	17	63	4	9	5.3
Reef	18	56	4	9	4.7
Reef	19	75	5.5	9	6.3
Reef	20	67	3.5	10	5.6
Reef	21	59	3	14	4.9
Reef	22	41	2.5	8	3.4
Reef	23	59	3.5	11	4.9
Reef	24	42	2.5	6	3.5
Reef	25	89	5.5	8	7.4
Reef	26	76	5	10	6.3
Reef	27	33	1.5	6	2.8
Reef	28	65	4	10	5.4
Reef	29	77	7	11	6.4
Reef	30	89	7	13	7.4
Reef	31	114	11	16	9.5
Reef	32	49	3	11	4.1
Reef	33	65	4.5	11	5.4
ShB	1	19	0.5	5	1.6
ShB	2	21	1	5	1.8
ShB	3	24	0	8	2.0
ShB	4	38	3.5	7	3.2
ShB	5	18	0	5	1.5
ShB	6	50	2.5	9	4.2
ShB	7	44	3.5	6	3.7
ShB	8	26	1.5	5	2.2
ShB	9	26	1	5	2.2
ShB	10	38	3	7	3.2
ShB	11	27	2.5	4	2.3
ShB	12	17	1	3	1.5
ShB	13	24	1.5	4	2.0
ShB	14	3	0	2	0.3
ShB	15	14	0	4	1.2

Species: *Aricidea* sp.

Site	Series	Total	Median	Range	Mean
ShB	16	17	1	2	1.4
ShB	17	47	3	9	3.9
ShB	18	20	1	4	1.7
ShB	19	42	1	7	3.5
ShB	20	59	1	15	4.9
ShB	21	46	2	6	3.8
ShB	22	28	1	4	2.3
ShB	23	23	1.5	5	1.9
ShB	24	26	1.5	5	2.2
ShB	25	9	1	1	0.8
ShB	26	33	2	6	2.8
ShB	27	11	0.5	2	0.9
ShB	28	12	1	2	1.0
ShB	29	41	2.5	7	3.4
ShB	30	32	2.5	6	2.7
ShB	31	56	3.5	6	4.7
ShB	32	21	1	4	1.8
ShB	33	22	1	2	1.8
Whau	1	344	25.5	59	28.7
Whau	2	482	36	59	40.2
Whau	3	458	36.5	50	38.2
Whau	4	9	0.5	2	0.8
Whau	5	598	52	79	49.8
Whau	6	567	47	41	47.3
Whau	7	746	57	99	62.2
Whau	8	523	37	58	43.6
Whau	9	432	30	59	36.0
Whau	10	332	16.5	58	27.7
Whau	11	193	11.5	27	16.1
Whau	12	399	18	86	33.3
Whau	13	325	22	41	27.1
Whau	14	68	4.5	11	5.7
Whau	15	113	5.5	29	9.4
Whau	16	212	10.5	44	17.7
Whau	17	130	7.5	22	10.8
Whau	18	145	10	25	12.1
Whau	19	175	8	32	14.6
Whau	20	179	8.5	28	14.9
Whau	21	113	5.5	29	9.4
Whau	22	165	11.5	18	13.8
Whau	23	269	22.5	40	22.4
Whau	24	123	10	23	10.3
Whau	25	207	16	24	17.3
Whau	26	267	16.5	47	22.3
Whau	27	34	2.5	5	2.8
Whau	28	62	5.5	11	5.2
Whau	29	69	4.5	13	5.8
Whau	30	145	9	18	12.1
Whau	31	276	17.5	43	23.0
Whau	32	197	15.5	29	16.4
Whau	33	99	8	16	8.3

Species: *Arthritica bifurca*

Site	Series	Total	Median	Range	Mean
HBV	1	0	0	0	0.0
HBV	2	1	0	0	0.1
HBV	3	1	0	0	0.1
HBV	4	2	0	1	0.2
HBV	5	3	0	1	0.3
HBV	6	1	0	0	0.1
HBV	7	0	0	0	0.0
HBV	8	3	0	1	0.3
HBV	9	4	0	1	0.3
HBV	10	4	0	1	0.4
HBV	11	6	0	1	0.5
HBV	12	1	0	0.5	0.1
HBV	13	7	0	0	0.6
HBV	14	0	0	0	0.0
HBV	15	0	0	0	0.0
HBV	16	0	0	0	0.0
HBV	17	3	0	1	0.3
HBV	18	2	0	1	0.2
HBV	19	0	0	0	0.0
HBV	20	3	0	1	0.3
HBV	21	1	0	0	0.1
HBV	22	7	0	2	0.6
HBV	23	0	0	0	0.0
HBV	24	9	0.5	2	0.8
HBV	25	9	0	1	0.8
HBV	26	10	0	3	0.8
HBV	27	5	0	1	0.4
HBV	28	1	0	0	0.1
HBV	29	0	0	0	0.0
HBV	30	1	0	0	0.1
HBV	31	0	0	0	0.0
HBV	32	2	0	0	0.2
HBV	33	6	0	1	0.5
HC	1	10	0	2	0.8
HC	2	0	0	0	0.0
HC	3	0	0	0	0.0
HC	4	8	0	2	0.7
HC	5	26	1.5	4	2.2
HC	6	15	1	3	1.3
HC	7	6	0	2	0.5
HC	8	10	0	3	0.8
HC	9	3	0	1	0.3
HC	10	19	0	7	1.6
HC	11	21	1	6	1.8
HC	12	2	0	1	0.2
HC	13	0	0	0	0.0
HC	14	0	0	0	0.0
HC	15	11	0	1	0.9
HC	16	2	0	1	0.2
HC	17	1	0	0	0.1
HC	18	0	0	0	0.0
HC	19	0	0	0	0.0
HC	20	0	0	0	0.0
HC	21	3	0	1	0.3
HC	22	49	0.5	19	4.1
HC	23	41	2.5	8	3.4
HC	24	0	0	0	0.0
HC	25	31	1	6	2.6
HC	26	3	0	0	0.3
HC	27	0	0	0	0.0
HC	28	2	0	1	0.2
HC	29	17	0.5	4	1.4
HC	30	17	1	3	1.4
HC	31	9	0	2	0.8
HC	32	16	0	6	1.3
HC	33	16	0	2	1.3
Reef	1	0	0	0	0.0
Reef	2	0	0	0	0.0
Reef	3	0	0	0	0.0
Reef	4	15	0.5	2	1.3
Reef	5	0	0	0	0.0
Reef	6	0	0	0	0.0
Reef	7	0	0	0	0.0
Reef	8	0	0	0	0.0
Reef	9	7	0	2	0.6
Reef	10	1	0	0	0.1
Reef	11	3	0	1	0.3
Reef	12	0	0	0	0.0
Reef	13	13	1	2	1.1
Reef	14	16	1	3.5	1.4
Reef	15	4	0	1	0.3
Reef	16	3	0	1	0.3
Reef	17	6	0	2	0.5
Reef	18	45	2	14	3.8
Reef	19	124	6.5	18	10.3
Reef	20	61	3.5	11	5.1
Reef	21	22	1.5	4	1.8
Reef	22	2	0	1	0.2
Reef	23	17	1	3	1.4
Reef	24	22	0.5	4	1.8
Reef	24	9	0	3	0.8
Reef	25	9	0	1	0.8
Reef	26	25	0.5	5	2.1
Reef	27	0	0	0	0.0
Reef	28	0	0	0	0.0
Reef	29	13	0	2	1.1
Reef	30	1	0	0	0.1
Reef	31	1	0	0	0.1
Reef	32	6	0	1	0.5
Reef	33	5	0	2	0.4
ShB	1	0	0	0	0.0
ShB	2	0	0	0	0.0
ShB	3	0	0	0	0.0
ShB	4	1	0	0	0.1
ShB	5	1	0	0	0.1
ShB	6	3	0	0	0.3
ShB	7	0	0	0	0.0
ShB	8	0	0	0	0.0
ShB	9	1	0	0	0.1
ShB	10	1	0	0	0.1
ShB	11	0	0	0	0.0
ShB	12	0	0	0	0.0
ShB	13	0	0	0	0.0
ShB	14	0	0	0	0.0

Species: *Arthritica bifurca* cont.

Site	Series	Total	Median	Range	Mean
ShB	15	0	0	0	0.0
ShB	16	0	0	0	0.0
ShB	17	0	0	0	0.0
ShB	18	0	0	0	0.0
ShB	19	1	0	0	0.1
ShB	20	0	0	0	0.0
ShB	21	11	0	1	0.9
ShB	22	0	0	0	0.0
ShB	23	0	0	0	0.0
ShB	24	6	0	2	0.5
ShB	25	9	0	3	0.8
ShB	26	1	0	0	0.1
ShB	27	0	0	0	0.0
ShB	28	1	0	0	0.1
ShB	29	2	0	1	0.2
ShB	30	0	0	0	0.0
ShB	31	4	0	0	0.3
ShB	32	0	0	0	0.0
ShB	33	0	0	0	0.0
Whau	1	0	0	0	0.0
Whau	2	3	0	1	0.3
Whau	3	10	0	2	0.8
Whau	4	13	0	5	1.1
Whau	5	3	0	1	0.3
Whau	6	12	0	3	1.0
Whau	7	3	0	1	0.3
Whau	8	5	0	1	0.4
Whau	9	15	0	3	1.3
Whau	10	4	0	1	0.3
Whau	11	1	0	0	0.1
Whau	12	0	0	0	0.0
Whau	13	0	0	0	0.0
Whau	14	0	0	0	0.0
Whau	15	3	0	1	0.3
Whau	16	1	0	0	0.1
Whau	17	3	0	1	0.3
Whau	18	2	0	0	0.2
Whau	19	4	0	1	0.3
Whau	20	14	1	3	1.2
Whau	21	3	0	1	0.3
Whau	22	10	0.5	2	0.8
Whau	23	11	1	2	0.9
Whau	24	7	0	2	0.6
Whau	25	4	0	1	0.3
Whau	26	4	0	1	0.3
Whau	27	2	0	1	0.2
Whau	28	3	0	1	0.3
Whau	29	13	0.5	3	1.1
Whau	30	11	0	4	0.9
Whau	31	1	0	0	0.1
Whau	32	3	0	1	0.3
Whau	33	3	0	1	0.3

Species: *Austrovenus stutchburyi*

Site	Series	Total	Median	Range	Mean
HBV	1	82	7	7	6.9
HBV	2	140	13	18	11.7
HBV	3	121	10	13	10.1
HBV	4	174	13	15	14.5
HBV	5	161	12	10	13.4
HBV	6	132	12	12	11.0
HBV	7	160	13	12	13.3
HBV	8	136	10	13	11.3
HBV	9	200	15.5	12	16.7
HBV	10	163	13	15	13.6
HBV	11	199	14.5	11	16.6
HBV	12	166	13.5	8.5	13.9
HBV	13	153	12	13	12.8
HBV	14	161	13	12	13.5
HBV	15	233	18.5	16	19.4
HBV	16	185	14	24	15.4
HBV	17	142	10.5	14	11.8
HBV	18	162	9	27	13.5
HBV	19	147	11	10	12.3
HBV	20	180	15	20	15.0
HBV	21	202	17	16	16.8
HBV	22	180	14	18	15.0
HBV	23	168	13.5	14	14.0
HBV	24	165	12	13	13.8
HBV	25	143	12	18	11.9
HBV	26	161	12.5	20	13.4
HBV	27	169	13	19	14.1
HBV	28	163	13	11	13.6
HBV	29	178	15.5	21	14.8
HBV	30	146	12	13	12.2
HBV	31	156	13	14	13.0
HBV	32	158	11	17	13.2
HBV	33	180	14	10	15.0
HC	1	210	14.5	29	17.5
HC	2	242	21.5	23	20.2
HC	3	358	32.5	28	29.8
HC	4	428	34.5	38	35.7
HC	5	454	38.5	42	37.8
HC	6	426	33	23	35.5
HC	7	433	31.5	37	36.1
HC	8	485	39	30	40.4
HC	9	450	36.5	30	37.5
HC	10	456	38.5	25	38.0
HC	11	424	34	23	35.3
HC	12	372	31	37	31.0
HC	13	299	26.5	16	24.9
HC	14	336	30	28	28.0
HC	15	527	46.5	37	43.9
HC	16	466	38	27	38.8
HC	17	386	32.5	23	32.2
HC	18	384	33	24	32.0
HC	19	447	39.5	24	37.3
HC	20	410	34	40	34.2
HC	21	376	32.5	24	31.3
HC	22	318	23	25	26.5
HC	23	337	26.5	24	28.1

Site	Series	Total	Median	Range	Mean
HC	24	590	28.5	107	49.2
HC	25	257	23	33	21.4
HC	26	315	28.5	33	26.3
HC	27	303	27	32	25.3
HC	28	335	26.5	25	27.9
HC	29	371	33	27	30.9
HC	30	297	23.5	20	24.8
HC	31	273	25	31	22.8
HC	32	349	29.5	17	29.1
HC	33	243	19.5	24	20.3
Reef	1	3	0	0	0.3
Reef	2	173	14	18	14.4
Reef	3	53	3.5	9	4.4
Reef	4	49	2.5	10	4.1
Reef	5	24	1	3	2.0
Reef	6	16	1.5	3	1.3
Reef	7	10	0.5	2	0.8
Reef	8	29	1.5	6	2.4
Reef	9	31	1	8	2.6
Reef	10	3	0	1	0.3
Reef	11	4	0	1	0.3
Reef	12	0	0	0	0.0
Reef	13	13	1	2	1.1
Reef	14	16	1	3.5	1.4
Reef	15	4	0	1	0.3
Reef	16	3	0	1	0.3
Reef	17	6	0	2	0.5
Reef	18	45	2	14	3.8
Reef	19	124	6.5	18	10.3
Reef	20	61	3.5	11	5.1
Reef	21	22	1.5	4	1.8
Reef	22	2	0	1	0.2
Reef	23	15	1	2	1.3
Reef	24	30	0.5	10	2.5
Reef	25	24	1	5	2.0
Reef	26	81	5	11	6.8
Reef	27	6	0	1	0.5
Reef	28	6	0	2	0.5
Reef	29	17	0	1	1.4
Reef	30	6	0	2	0.5
Reef	31	5	0	1	0.4
Reef	32	66	4.5	10	5.5
Reef	33	7	0.5	1	0.6
ShB	1	21	1.5	4	1.8
ShB	2	23	2	4	1.9
ShB	3	55	2	13	4.6
ShB	4	63	5	9	5.3
ShB	5	48	3	8	4.0
ShB	6	29	3	4	2.4
ShB	7	38	3	7	3.2
ShB	8	37	2.5	8	3.1
ShB	9	38	2.5	7	3.2
ShB	10	41	2	8	3.4
ShB	11	23	1.5	4	1.9
ShB	12	45	3	8	3.8
ShB	13	15	0.5	4	1.3
ShB	14	36	3	7	3.0
ShB	15	64	5	10	5.3

Species: *Austrovenus stutchburyi* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	44	2.5	9	3.7
ShB	17	24	0.5	6	2.0
ShB	18	26	2	4	2.2
ShB	19	7	0	1	0.6
ShB	20	199	6	54	16.6
ShB	21	39	1.5	6	3.3
ShB	22	19	0	6	1.6
ShB	23	16	0	4	1.3
ShB	24	29	1	8	2.4
ShB	25	14	1	2	1.2
ShB	26	114	4.5	11	9.5
ShB	27	51	3	10	4.3
ShB	28	11	0	3	0.9
ShB	29	4	0	1	0.3
ShB	30	14	0.5	2	1.2
ShB	31	22	1	4	1.8
ShB	32	19	1.5	4	1.6
ShB	33	17	0	6	1.4
Whau	1	149	11.5	17	12.4
Whau	2	322	22.5	46	26.8
Whau	3	513	41.5	39	42.8
Whau	4	96	8.5	9	8.0
Whau	5	210	16.5	23	17.5
Whau	6	197	16.5	20	16.4
Whau	7	135	10	15	11.3
Whau	8	404	34.5	26	33.7
Whau	9	233	16.5	25	19.4
Whau	10	0	0	0	0.0
Whau	11	119	9.5	14	9.9
Whau	12	125	9	13	10.4
Whau	13	71	6.5	9	5.9
Whau	14	157	12.5	18	13.1
Whau	15	253	17.5	21	21.1
Whau	16	252	14.5	30	21.0
Whau	17	328	26	21	27.3
Whau	18	141	10	13	11.8
Whau	19	206	18	22	17.2
Whau	20	759	68.5	60	63.3
Whau	21	253	17.5	21	21.1
Whau	22	84	6.5	10	7.0
Whau	23	103	9	12	8.6
Whau	24	127	9	13	10.6
Whau	25	92	7	9	7.7
Whau	26	1034	90	134	86.2
Whau	27	149	12	15	12.4
Whau	28	74	6	9	6.2
Whau	29	0	0	0	0.0
Whau	30	46	4	4	3.8
Whau	31	52	3.5	5	4.3
Whau	32	370	30.5	41	30.8
Whau	33	58	5.5	6	4.8

Species: *Boccardia syrtis*

Site	Series	Total	Median	Range	Mean
HBV	1	4	0	1	0.4
HBV	2	4	0	1	0.3
HBV	3	1	0	0	0.1
HBV	4	2	0	1	0.2
HBV	5	3	0	1	0.3
HBV	6	4	0	1	0.3
HBV	7	10	1	2	0.8
HBV	8	3	0	1	0.3
HBV	9	11	0.5	3	0.9
HBV	10	0	0	0	0.0
HBV	11	1	0	0	0.1
HBV	12	3	0	1	0.3
HBV	13	2	0	1	0.2
HBV	14	1	0	0	0.1
HBV	15	2	0	1	0.2
HBV	16	3	0	1	0.3
HBV	17	7	0.5	1	0.6
HBV	18	6	0	1	0.5
HBV	19	2	0	1	0.2
HBV	20	1	0	0	0.1
HBV	21	0	0	0	0.0
HBV	22	1	0	0	0.1
HBV	23	4	0	1	0.3
HBV	24	2	0	1	0.2
HBV	25	2	0	1	0.2
HBV	26	4	0	1	0.3
HBV	27	0	0	0	0.0
HBV	28	3	0	1	0.3
HBV	29	5	0	1	0.4
HBV	30	8	1	1	0.7
HBV	31	1	0	0	0.1
HBV	32	0	0	0	0.0
HBV	33	0	0	0	0.0
HC	1	98	5	20	8.2
HC	2	12	0.5	2	1.0
HC	3	19	1	4	1.6
HC	4	33	3	5	2.8
HC	5	40	2	8	3.3
HC	6	31	2.5	5	2.6
HC	7	15	0	1	1.3
HC	8	16	1	4	1.3
HC	9	5	0	1	0.4
HC	10	2	0	0	0.2
HC	11	2	0	1	0.2
HC	12	3	0	1	0.3
HC	13	7	0	2	0.6
HC	14	0	0	0	0.0
HC	15	3	0	1	0.3
HC	16	2	0	1	0.2
HC	17	1	0	0	0.1
HC	18	5	0	2	0.4
HC	19	7	0.5	1	0.6
HC	20	7	0	2	0.6
HC	21	3	0	1	0.3
HC	22	13	1	2	1.1
HC	23	2	0	1	0.2

Site	Series	Total	Median	Range	Mean
HC	24	0	0	0	0.0
HC	25	5	0	1	0.4
HC	26	1	0	0	0.1
HC	27	2	0	0	0.2
HC	28	2	0	1	0.2
HC	29	3	0	1	0.3
HC	30	4	0	1	0.3
HC	31	6	0	1	0.5
HC	32	0	0	0	0.0
HC	33	3	0	1	0.3
Reef	1	14	0.5	3	1.2
Reef	2	9	0	1	0.8
Reef	3	11	0	1	0.9
Reef	4	12	1	2	1.0
Reef	5	23	2	3	1.9
Reef	6	19	1	4	1.6
Reef	7	3	0	1	0.3
Reef	8	3	0	1	0.3
Reef	9	2	0	1	0.2
Reef	10	4	0	1	0.4
Reef	11	9	0.5	1	0.8
Reef	12	3	0	1	0.3
Reef	13	6	0	1	0.5
Reef	14	4	0	1.5	0.4
Reef	15	6	0	2	0.5
Reef	16	13	0.5	2	1.1
Reef	17	40	2	7	3.3
Reef	18	42	1.5	10	3.5
Reef	19	39	2.5	6	3.3
Reef	20	32	1.5	7	2.7
Reef	21	27	1.5	6	2.3
Reef	22	10	0	1	0.8
Reef	23	38	2.5	8	3.2
Reef	24	30	2	4	2.5
Reef	25	19	1	3	1.6
Reef	26	1	0	0	0.1
Reef	27	2	0	0	0.2
Reef	28	142	9	21	11.8
Reef	29	328	25	46	27.3
Reef	30	470	33.5	73	39.2
Reef	31	25	1	4	2.1
Reef	32	19	1	4	1.6
Reef	33	5	0	2	0.4
ShB	1	47	3.5	10	3.9
ShB	2	42	2	10	3.5
ShB	3	38	2.5	6	3.2
ShB	4	43	2	11	3.6
ShB	5	27	0	4	2.3
ShB	6	32	2	5	2.7
ShB	7	30	2.5	4	2.5
ShB	8	16	1	3	1.3
ShB	9	10	0.5	1	0.8
ShB	10	31	1.5	6	2.6
ShB	11	21	1	6	1.8
ShB	12	28	2	7	2.4
ShB	13	9	0	3	0.8
ShB	14	6	0	3	0.5
ShB	15	13	0	3	1.1

Species: *Boccardia syrtis*

Site	Series	Total	Median	Range	Mean
ShB	16	64	1	20	5.3
ShB	17	32	1	6	2.7
ShB	18	21	0.5	5	1.8
ShB	19	34	1	10	2.8
ShB	20	131	2	31	10.9
ShB	21	52	1.5	9	4.3
ShB	22	51	3	7	4.3
ShB	23	71	5	15	5.9
ShB	24	56	2.5	11	4.7
ShB	25	12	1	2	1.0
ShB	26	59	2.5	9	4.9
ShB	27	25	1.5	4	2.1
ShB	28	87	5.5	16	7.3
ShB	29	96	4.5	22	8.0
ShB	30	51	2.5	10	4.3
ShB	31	82	4	21	6.8
ShB	32	56	2	13	4.7
ShB	33	44	2.5	6	3.7
Whau	1	24	1	4	2.0
Whau	2	17	1	4	1.4
Whau	3	9	0	1	0.8
Whau	4	19	0.5	5	1.6
Whau	5	27	0.5	8	2.3
Whau	6	17	1	4	1.4
Whau	7	8	0	2	0.7
Whau	8	17	1	3	1.4
Whau	9	8	0	3	0.7
Whau	10	6	0	2	0.5
Whau	11	3	0	1	0.3
Whau	12	9	0.5	2	0.8
Whau	13	4	0	1	0.3
Whau	14	8	0	2	0.7
Whau	15	21	1	2	1.8
Whau	16	27	1	8	2.3
Whau	17	16	1	3	1.3
Whau	18	16	0	5	1.3
Whau	19	4	0	1	0.3
Whau	20	26	1	5	2.2
Whau	21	21	1	2	1.8
Whau	22	32	1	8	2.7
Whau	23	41	2	8	3.4
Whau	24	26	1	5	2.2
Whau	25	30	2	5	2.5
Whau	26	27	2	5	2.3
Whau	27	5	0	1	0.4
Whau	28	34	1.5	8	2.8
Whau	29	15	1	4	1.3
Whau	30	12	0.5	2	1.0
Whau	31	9	0	2	0.8
Whau	32	13	1	2	1.1
Whau	33	5	0	1	0.4

Species: *Colurostylis lemurum*

Site	Series	Total	Median	Range	Mean
HBV	1	14	1	3	1.2
HBV	2	10	0.5	2	0.8
HBV	3	11	1	1	0.9
HBV	4	50	3.5	10	4.2
HBV	5	26	2	3	2.2
HBV	6	42	3	6	3.5
HBV	7	26	2	5	2.2
HBV	8	21	1	4	1.8
HBV	9	15	1	2	1.3
HBV	10	70	4	10	5.9
HBV	11	47	3.5	8	3.9
HBV	12	56	4	10.5	4.7
HBV	13	28	2	5	2.3
HBV	14	18	0	5	1.5
HBV	15	35	1.5	8	2.9
HBV	16	29	1.5	5	2.4
HBV	17	10	1	2	0.8
HBV	18	20	1	6	1.7
HBV	19	20	1	4	1.7
HBV	20	26	1.5	5	2.2
HBV	21	30	1.5	5	2.5
HBV	22	21	1	4	1.8
HBV	23	17	1.5	3	1.4
HBV	24	36	2.5	6	3.0
HBV	25	34	2.5	5	2.8
HBV	26	20	1	4	1.7
HBV	27	11	1	2	0.9
HBV	28	11	1	2	0.9
HBV	29	16	1	4	1.3
HBV	30	55	4.5	6	4.6
HBV	31	26	2	4	2.2
HBV	32	24	2	3	2.0
HBV	33	21	1.5	4	1.8
HC	1	15	1	3	1.3
HC	2	1	0	0	0.1
HC	3	16	1	5	1.3
HC	4	17	0	4	1.4
HC	5	23	1.5	2	1.9
HC	6	32	2.5	4	2.7
HC	7	13	0.5	3	1.1
HC	8	15	0	5	1.3
HC	9	9	0	3	0.8
HC	10	24	1.5	6	2.0
HC	11	10	1	2	0.8
HC	12	26	2	5	2.2
HC	13	20	1.5	3	1.7
HC	14	9	0	3	0.8
HC	15	18	1	5	1.5
HC	16	9	0.5	2	0.8
HC	17	12	1	3	1.0
HC	18	20	1	5	1.7
HC	19	22	1	4	1.8
HC	20	22	1	4	1.8
HC	21	14	1	2	1.2
HC	22	39	2	7	3.3
HC	23	25	2	4	2.1

Site	Series	Total	Median	Range	Mean
HC	24	27	1.5	5	2.3
HC	25	16	1	2	1.3
HC	26	33	2.5	5	2.8
HC	27	3	0	0	0.3
HC	28	13	0.5	2	1.1
HC	29	31	1	7	2.6
HC	30	41	2	8	3.4
HC	31	20	2	3	1.7
HC	32	19	1	4	1.6
HC	33	22	1	5	1.8
Reef	1	4	0	2	0.3
Reef	2	19	1	5	1.6
Reef	3	9	0	2	0.8
Reef	4	94	4.5	19	7.8
Reef	5	218	9.5	46	18.2
Reef	6	11	0.5	1	0.9
Reef	7	8	0	2	0.7
Reef	8	2	0	0	0.2
Reef	9	9	0	2	0.8
Reef	10	54	4	8	4.5
Reef	11	22	2	3	1.8
Reef	12	2	0	1	0.2
Reef	13	6	0	1	0.5
Reef	14	0	0	0	0.0
Reef	15	9	0	3	0.8
Reef	16	48	1.5	9	4.0
Reef	17	44	1	10	3.7
Reef	18	7	1	1	0.6
Reef	19	72	6.5	10	6.0
Reef	20	22	1	5	1.8
Reef	21	4	0	1	0.3
Reef	22	31	2	6	2.6
Reef	23	23	1	4	1.9
Reef	24	35	1.5	8	2.9
Reef	25	6	0	1	0.5
Reef	26	29	2	5	2.4
Reef	27	11	0.5	2	0.9
Reef	28	12	0.5	2	1.0
Reef	29	11	0	2	0.9
Reef	30	8	0	2	0.7
Reef	31	14	0	3	1.2
Reef	32	3	0	1	0.3
Reef	33	2	0	1	0.2
ShB	1	9	0	2	0.8
ShB	2	9	0	2	0.8
ShB	3	16	0	4	1.3
ShB	4	26	0.5	4	2.2
ShB	5	38	1	11	3.2
ShB	6	19	0	3	1.6
ShB	7	17	1	4	1.4
ShB	8	22	1	4	1.8
ShB	9	31	0.5	8	2.6
ShB	10	113	8	18	9.4
ShB	11	7	0	2	0.6
ShB	12	13	0	3	1.1
ShB	13	6	0	2	0.5
ShB	14	16	1	5	1.4
ShB	15	61	4.5	8	5.1

Species: *Colurostylis lemurum* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	34	1.5	5	2.8
ShB	17	22	1	6	1.8
ShB	18	18	1.5	3	1.5
ShB	19	41	2.5	8	3.4
ShB	20	45	3.5	10	3.8
ShB	21	6	0	1	0.5
ShB	22	17	1	3	1.4
ShB	23	3	0	1	0.3
ShB	24	12	0	3	1.0
ShB	25	18	1	4	1.5
ShB	26	26	0	2	2.2
ShB	27	29	2	5	2.4
ShB	28	6	0	1	0.5
ShB	29	9	0	1	0.8
ShB	30	14	1	3	1.2
ShB	31	15	0	3	1.3
ShB	32	4	0	1	0.3
ShB	33	7	0	2	0.6
Whau	1	13	1	2	1.1
Whau	2	14	1	3	1.2
Whau	3	6	0	1	0.5
Whau	4	18	2	3	1.5
Whau	5	50	3	8	4.2
Whau	6	12	0	4	1.0
Whau	7	11	1	2	0.9
Whau	8	7	0.5	1	0.6
Whau	9	18	2	2	1.5
Whau	10	80	5.5	12	6.7
Whau	11	10	0.5	2	0.8
Whau	12	41	3	7	3.4
Whau	13	5	0	1	0.4
Whau	14	8	0.5	2	0.7
Whau	15	4	0	1	0.3
Whau	16	29	1.5	4	2.4
Whau	17	21	1	4	1.8
Whau	18	25	1.5	3	2.1
Whau	19	27	2	5	2.3
Whau	20	19	1.5	3	1.6
Whau	21	4	0	1	0.3
Whau	22	18	1	3	1.5
Whau	23	27	1	2	2.3
Whau	24	47	4.5	6	3.9
Whau	25	14	1	3	1.2
Whau	26	20	1.5	3	1.7
Whau	27	21	2	2	1.8
Whau	28	15	1	4	1.3
Whau	29	16	1	3	1.3
Whau	30	19	1	4	1.6
Whau	31	20	2	3	1.7
Whau	32	16	1	3	1.3
Whau	33	28	2	3	2.3

Species: *Diloma subrostrata*

Site	Series	Total	Median	Range	Mean
HBV	1	6	0	2	0.5
HBV	2	3	0	1	0.3
HBV	3	0	0	0	0.0
HBV	4	5	0	1	0.4
HBV	5	10	1	2	0.8
HBV	6	1	0	0	0.1
HBV	7	0	0	0	0.0
HBV	8	0	0	0	0.0
HBV	9	2	0	1	0.2
HBV	10	10	1	2	0.9
HBV	11	10	0.5	2	0.8
HBV	12	4	0	2	0.4
HBV	13	2	0	1	0.2
HBV	14	8	1	2	0.7
HBV	15	1	0	0	0.1
HBV	16	19	2	3	1.6
HBV	17	8	0.5	1	0.7
HBV	18	3	0	1	0.3
HBV	19	6	0	1	0.5
HBV	20	7	0.5	1	0.6
HBV	21	2	0	1	0.2
HBV	22	2	0	1	0.2
HBV	23	2	0	1	0.2
HBV	24	12	0.5	3	1.0
HBV	25	13	0.5	4	1.1
HBV	26	6	0	2	0.5
HBV	27	11	1	2	0.9
HBV	28	3	0	1	0.3
HBV	29	8	0	2	0.7
HBV	30	2	0	1	0.2
HBV	31	15	0	4	1.3
HBV	32	12	0.5	3	1.0
HBV	33	1	0	0	0.1
HC	1	16	2	2	1.3
HC	2	14	1	2	1.2
HC	3	2	0	1	0.2
HC	4	8	0	2	0.7
HC	5	8	0.5	1	0.7
HC	6	5	0	1	0.4
HC	7	43	3.5	7	3.6
HC	8	4	0	1	0.3
HC	9	14	1	2	1.2
HC	10	26	1.5	6	2.2
HC	11	18	1	4	1.5
HC	12	7	1	1	0.6
HC	13	2	0	1	0.2
HC	14	1	0	0.5	0.1
HC	15	8	0	1	0.7
HC	16	10	1	2	0.8
HC	17	8	0	2	0.7
HC	18	10	1	2	0.8
HC	19	5	0	2	0.4
HC	20	5	0	1	0.4
HC	21	4	0	1	0.3
HC	22	8	1	1	0.7
HC	23	5	0	1	0.4
HC	24	20	0	3	1.7
HC	25	12	1	3	1.0
HC	26	4	0	1	0.3
HC	27	7	0	2	0.6
HC	28	6	0	2	0.5
HC	29	6	0	1	0.5
HC	30	9	0.5	1	0.8
HC	31	4	0	1	0.3
HC	32	15	1	4	1.3
HC	33	2	0	0	0.2
Reef	1	2	0	0	0.2
Reef	2	3	0	1	0.3
Reef	3	1	0	0	0.1
Reef	4	0	0	0	0.0
Reef	5	0	0	0	0.0
Reef	6	1	0	0	0.1
Reef	7	0	0	0	0.0
Reef	8	0	0	0	0.0
Reef	9	0	0	0	0.0
Reef	10	2	0	1	0.2
Reef	11	0	0	0	0.0
Reef	12	0	0	0	0.0
Reef	13	0	0	0	0.0
Reef	14	0	0	0	0.0
Reef	15	0	0	0	0.0
Reef	16	0	0	0	0.0
Reef	17	0	0	0	0.0
Reef	18	0	0	0	0.0
Reef	19	0	0	0	0.0
Reef	20	0	0	0	0.0
Reef	21	0	0	0	0.0
Reef	22	0	0	0	0.0
Reef	23	0	0	0	0.0
Reef	24	0	0	0	0.0
Reef	25	1	0	0	0.1
Reef	26	0	0	0	0.0
Reef	27	0	0	0	0.0
Reef	28	0	0	0	0.0
Reef	29	0	0	0	0.0
Reef	30	0	0	0	0.0
Reef	31	0	0	0	0.0
Reef	32	0	0	0	0.0
Reef	33	0	0	0	0.0
ShB	1	6	0	2	0.5
ShB	2	5	0	1	0.4
ShB	3	2	0	1	0.2
ShB	4	9	0	2	0.8
ShB	5	3	0	0	0.3
ShB	6	0	0	0	0.0
ShB	7	2	0	0	0.2
ShB	8	1	0	0	0.1
ShB	9	0	0	0	0.0
ShB	10	9	0.5	2	0.8
ShB	11	5	0	1	0.4
ShB	12	3	0	1	0.3
ShB	13	1	0	0	0.1
ShB	14	0	0	0	0.0
ShB	15	2	0	1	0.2

Species: *Diloma subrostrata* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	1	0	0	0.1
ShB	17	8	0	2	0.7
ShB	18	1	0	0	0.1
ShB	19	0	0	0	0.0
ShB	20	3	0	1	0.3
ShB	21	1	0	0	0.1
ShB	22	2	0	0	0.2
ShB	23	0	0	0	0.0
ShB	24	16	1	3	1.3
ShB	25	8	1	1	0.7
ShB	26	4	0	1	0.3
ShB	27	4	0	1	0.3
ShB	28	2	0	1	0.2
ShB	29	4	0	1	0.3
ShB	30	10	0	2	0.8
ShB	31	6	0	2	0.5
ShB	32	8	0	2	0.7
ShB	33	0	0	0	0.0
Whau	1	0	0	0	0.0
Whau	2	8	0.5	1	0.7
Whau	3	5	0	1	0.4
Whau	4	3	0	2	0.3
Whau	5	1	0	0	0.1
Whau	6	3	0	1	0.3
Whau	7	0	0	0	0.0
Whau	8	0	0	0	0.0
Whau	9	2	0	1	0.2
Whau	10	0	0	0	0.0
Whau	11	2	0	1	0.2
Whau	12	0	0	0	0.0
Whau	13	0	0	0	0.0
Whau	14	0	0	0	0.0
Whau	15	3	0	1	0.3
Whau	16	2	0	1	0.2
Whau	17	0	0	0	0.0
Whau	18	1	0	0	0.1
Whau	19	3	0	1	0.3
Whau	20	1	0	0	0.1
Whau	21	3	0	1	0.3
Whau	22	1	0	0	0.1
Whau	23	1	0	0	0.1
Whau	24	1	0	0	0.1
Whau	25	2	0	1	0.2
Whau	26	1	0	0	0.1
Whau	27	1	0	0	0.1
Whau	28	1	0	0	0.1
Whau	29	2	0	0	0.2
Whau	30	4	0	1	0.3
Whau	31	0	0	0	0.0
Whau	32	1	0	0	0.1
Whau	33	1	0	0	0.1

Species: *Euchone* sp.

Site	Series	Total	Median	Range	Mean
HBV	1	0	0	0	0.0
HBV	2	0	0	0	0.0
HBV	3	0	0	0	0.0
HBV	4	0	0	0	0.0
HBV	5	0	0	0	0.0
HBV	6	0	0	0	0.0
HBV	7	0	0	0	0.0
HBV	8	0	0	0	0.0
HBV	9	0	0	0	0.0
HBV	10	0	0	0	0.0
HBV	11	0	0	0	0.0
HBV	12	0	0	0	0.0
HBV	13	0	0	0	0.0
HBV	14	0	0	0	0.0
HBV	15	0	0	0	0.0
HBV	16	0	0	0	0.0
HBV	17	0	0	0	0.0
HBV	18	0	0	0	0.0
HBV	19	0	0	0	0.0
HBV	20	0	0	0	0.0
HBV	21	0	0	0	0.0
HBV	22	0	0	0	0.0
HBV	23	0	0	0	0.0
HBV	24	0	0	0	0.0
HBV	25	0	0	0	0.0
HBV	26	0	0	0	0.0
HBV	27	0	0	0	0.0
HBV	28	0	0	0	0.0
HBV	29	0	0	0	0.0
HBV	30	0	0	0	0.0
HBV	31	0	0	0	0.0
HBV	32	0	0	0	0.0
HBV	33	0	0	0	0.0
HC	1	0	0	0	0.0
HC	2	0	0	0	0.0
HC	3	0	0	0	0.0
HC	4	0	0	0	0.0
HC	5	1	0	0	0.1
HC	6	0	0	0	0.0
HC	7	0	0	0	0.0
HC	8	0	0	0	0.0
HC	9	0	0	0	0.0
HC	10	1	0	0	0.1
HC	11	0	0	0	0.0
HC	12	0	0	0	0.0
HC	13	0	0	0	0.0
HC	14	0	0	0	0.0
HC	15	0	0	0	0.0
HC	16	0	0	0	0.0
HC	17	0	0	0	0.0
HC	18	0	0	0	0.0
HC	19	0	0	0	0.0
HC	20	0	0	0	0.0
HC	21	0	0	0	0.0
HC	22	0	0	0	0.0
HC	23	0	0	0	0.0

Site	Series	Total	Median	Range	Mean
HC	24	0	0	0	0.0
HC	25	8	0	2	0.7
HC	26	0	0	0	0.0
HC	27	0	0	0	0.0
HC	28	0	0	0	0.0
HC	29	1	0	0	0.1
HC	30	0	0	0	0.0
HC	31	1	0	0	0.1
HC	32	0	0	0	0.0
HC	33	0	0	0	0.0
Reef	1	55	3	8	4.6
Reef	2	139	8	18	11.6
Reef	3	57	3.5	10	4.8
Reef	4	97	6.5	21	8.1
Reef	5	452	35	72	37.7
Reef	6	648	37	89	54.0
Reef	7	251	22.5	21	20.9
Reef	8	59	4.5	8	4.9
Reef	9	43	2.5	8	3.6
Reef	10	43	2	8	3.6
Reef	11	107	4	26	8.9
Reef	12	24	1.5	5	2.0
Reef	13	177	10	24	14.8
Reef	14	28	1	9	2.4
Reef	15	24	1	6	2.0
Reef	16	80	4	14	6.7
Reef	17	790	58.5	128	65.8
Reef	18	525	27	93	43.8
Reef	19	482	33.5	50	40.2
Reef	20	333	30.5	42	27.8
Reef	21	301	21.5	41	25.1
Reef	22	305	24.5	35	25.4
Reef	23	604	36.5	94	50.3
Reef	24	909	73	94	75.8
Reef	25	377	29.5	38	31.4
Reef	26	191	14	24	15.9
Reef	27	43	1	10	3.6
Reef	28	118	7	16	9.8
Reef	29	330	23.5	51	27.5
Reef	30	611	54	61	50.9
Reef	31	396	39.5	48	33.0
Reef	32	129	8.5	17	10.8
Reef	33	58	3.5	10	4.8
ShB	1	0	0	0	0.0
ShB	2	0	0	0	0.0
ShB	3	10	0	3	0.8
ShB	4	1	0	0	0.1
ShB	5	6	0	2	0.5
ShB	6	3	0	0	0.3
ShB	7	12	0.5	2	1.0
ShB	8	10	0	2	0.8
ShB	9	19	1	4	1.6
ShB	10	48	0	5	4.0
ShB	11	27	0	8	2.3
ShB	12	10	0	4	0.9
ShB	13	13	0	5	1.1
ShB	14	0	0	0	0.0
ShB	15	0	0	0	0.0

Species: *Euchone* sp. cont.

Site	Series	Total	Median	Range	Mean
ShB	16	13	1	2	1.1
ShB	17	23	0	7	1.9
ShB	18	14	0.5	4	1.2
ShB	19	17	1	3	1.4
ShB	20	59	1.5	11	4.9
ShB	21	35	0.5	5	2.9
ShB	22	169	14	26	14.1
ShB	23	156	5.5	39	13.0
ShB	24	223	5	78	18.6
ShB	25	52	1.5	11	4.3
ShB	26	44	2	8	3.7
ShB	27	79	3.5	15	6.6
ShB	28	78	3	16	6.5
ShB	29	150	6	31	12.5
ShB	30	52	1	11	4.3
ShB	31	76	1	18	6.3
ShB	32	37	1.5	5	3.1
ShB	33	19	1.5	3	1.6
Whau	1	0	0	0	0.0
Whau	2	0	0	0	0.0
Whau	3	0	0	0	0.0
Whau	4	0	0	0	0.0
Whau	5	1	0	0	0.1
Whau	6	0	0	0	0.0
Whau	7	0	0	0	0.0
Whau	8	0	0	0	0.0
Whau	9	0	0	0	0.0
Whau	10	0	0	0	0.0
Whau	11	0	0	0	0.0
Whau	12	0	0	0	0.0
Whau	13	0	0	0	0.0
Whau	14	0	0	0	0.0
Whau	15	1	0	0	0.1
Whau	16	0	0	0	0.0
Whau	17	0	0	0	0.0
Whau	18	0	0	0	0.0
Whau	19	0	0	0	0.0
Whau	20	10	0	2	0.8
Whau	21	1	0	0	0.1
Whau	22	0	0	0	0.0
Whau	23	2	0	0	0.2
Whau	24	3	0	0	0.3
Whau	25	2	0	1	0.2
Whau	26	2	0	1	0.2
Whau	27	0	0	0	0.0
Whau	28	0	0	0	0.0
Whau	29	0	0	0	0.0
Whau	30	2	0	0	0.2
Whau	31	0	0	0	0.0
Whau	32	13	0	2	1.1
Whau	33	1	0	0	0.1

Species: *Exosphaeroma* spp.

Site	Series	Total	Median	Range	Mean
HBV	1	3	0	1	0.3
HBV	2	24	2.5	4	2.0
HBV	3	12	1	2	1.0
HBV	4	17	1	3	1.4
HBV	5	38	1.5	8	3.2
HBV	6	22	1	6	1.8
HBV	7	11	0	3	0.9
HBV	8	19	1.5	3	1.6
HBV	9	21	1.5	3	1.8
HBV	10	66	5	8	5.5
HBV	11	36	2.5	6	3.0
HBV	12	20	1	4.5	1.7
HBV	13	12	0	2	1.0
HBV	14	16	1	3	1.4
HBV	15	24	2	3	2.0
HBV	16	7	0.5	1	0.6
HBV	17	10	1	2	0.8
HBV	18	13	0.5	2	1.1
HBV	19	13	1	2	1.1
HBV	20	22	2	4	1.8
HBV	21	14	1	3	1.2
HBV	22	20	1.5	3	1.7
HBV	23	0	0	0	0.0
HBV	24	30	2	5	2.5
HBV	25	25	1.5	5	2.1
HBV	26	41	3.5	6	3.4
HBV	27	34	2.5	6	2.8
HBV	28	4	0	1	0.3
HBV	29	10	0	2	0.8
HBV	30	6	0	1	0.5
HBV	31	15	1	3	1.3
HBV	32	11	0.5	2	0.9
HBV	33	2	0	1	0.2
HC	1	3	0	1	0.3
HC	2	3	0	1	0.3
HC	3	2	0	1	0.2
HC	4	9	0	3	0.8
HC	5	8	0	2	0.7
HC	6	4	0	1	0.3
HC	7	0	0	0	0.0
HC	8	9	0	2	0.8
HC	9	7	0	1	0.6
HC	10	2	0	0	0.2
HC	11	2	0	1	0.2
HC	12	3	0	0	0.3
HC	13	1	0	0	0.1
HC	14	6	0	1.5	0.5
HC	15	11	1	2	0.9
HC	16	4	0	1	0.3
HC	17	4	0	1	0.3
HC	18	0	0	0	0.0
HC	19	0	0	0	0.0
HC	20	7	0	2	0.6
HC	21	16	1	2	1.3
HC	22	5	0	2	0.4
HC	23	0	0	0	0.0

Site	Series	Total	Median	Range	Mean
HC	24	5	0	1	0.4
HC	25	7	0.5	1	0.6
HC	26	11	0.5	2	0.9
HC	27	3	0	1	0.3
HC	28	7	1	1	0.6
HC	29	3	0	1	0.3
HC	30	9	0.5	2	0.8
HC	31	1	0	0	0.1
HC	32	5	0	1	0.4
HC	33	10	1	2	0.8
Reef	1	0	0	0	0.0
Reef	2	0	0	0	0.0
Reef	3	0	0	0	0.0
Reef	4	0	0	0	0.0
Reef	5	1	0	0	0.1
Reef	6	4	0	1	0.3
Reef	7	0	0	0	0.0
Reef	8	0	0	0	0.0
Reef	9	0	0	0	0.0
Reef	10	0	0	0	0.0
Reef	11	0	0	0	0.0
Reef	12	0	0	0	0.0
Reef	13	0	0	0	0.0
Reef	14	0	0	0	0.0
Reef	15	1	0	0	0.1
Reef	16	0	0	0	0.0
Reef	17	0	0	0	0.0
Reef	18	0	0	0	0.0
Reef	19	0	0	0	0.0
Reef	20	0	0	0	0.0
Reef	21	0	0	0	0.0
Reef	22	0	0	0	0.0
Reef	23	0	0	0	0.0
Reef	24	1	0	0	0.1
Reef	25	0	0	0	0.0
Reef	26	0	0	0	0.0
Reef	27	0	0	0	0.0
Reef	28	0	0	0	0.0
Reef	29	0	0	0	0.0
Reef	30	0	0	0	0.0
Reef	31	0	0	0	0.0
Reef	32	0	0	0	0.0
Reef	33	0	0	0	0.0
ShB	1	0	0	0	0.0
ShB	2	0	0	0	0.0
ShB	3	1	0	0	0.1
ShB	4	2	0	1	0.2
ShB	5	0	0	0	0.0
ShB	6	0	0	0	0.0
ShB	7	0	0	0	0.0
ShB	8	1	0	0	0.1
ShB	9	0	0	0	0.0
ShB	10	1	0	0	0.1
ShB	11	1	0	0	0.1
ShB	12	0	0	0	0.0
ShB	13	0	0	0	0.0
ShB	14	3	0	1	0.3
ShB	15	0	0	0	0.0

Species: *Exosphaeroma* spp. Cont.

Site	Series	Total	Median	Range	Mean
ShB	16	2	0	1	0.2
ShB	17	1	0	0	0.1
ShB	18	1	0	0	0.1
ShB	19	0	0	0	0.0
ShB	20	3	0	0	0.3
ShB	21	0	0	0	0.0
ShB	22	2	0	1	0.2
ShB	23	0	0	0	0.0
ShB	24	3	0	1	0.3
ShB	25	1	0	0	0.1
ShB	26	4	0	1	0.3
ShB	27	0	0	0	0.0
ShB	28	1	0	0	0.1
ShB	29	1	0	0	0.1
ShB	30	2	0	1	0.2
ShB	31	1	0	0	0.1
ShB	32	0	0	0	0.0
ShB	33	0	0	0	0.0
Whau	1	1	0	0	0.1
Whau	2	1	0	0	0.1
Whau	3	5	0	1	0.4
Whau	4	4	0	2	0.4
Whau	5	1	0	0	0.1
Whau	6	0	0	0	0.0
Whau	7	0	0	0	0.0
Whau	8	0	0	0	0.0
Whau	9	2	0	1	0.2
Whau	10	4	0	1	0.3
Whau	11	0	0	0	0.0
Whau	12	0	0	0	0.0
Whau	13	2	0	1	0.2
Whau	14	3	0	1	0.3
Whau	15	0	0	0	0.0
Whau	16	1	0	0	0.1
Whau	17	1	0	0	0.1
Whau	18	0	0	0	0.0
Whau	19	2	0	1	0.2
Whau	20	2	0	1	0.2
Whau	21	0	0	0	0.0
Whau	22	4	0	1	0.3
Whau	23	1	0	0	0.1
Whau	24	4	0	1	0.3
Whau	25	0	0	0	0.0
Whau	26	0	0	0	0.0
Whau	27	0	0	0	0.0
Whau	28	4	0	1	0.3
Whau	29	2	0	1	0.2
Whau	30	5	0	2	0.4
Whau	31	1	0	0	0.1
Whau	32	0	0	0	0.0
Whau	33	1	0	0	0.1

Species*: Glycera* sp.

Site	Series	Total	Median	Range	Mean
HBV	1	0	0	0	0.0
HBV	2	1	0	0	0.1
HBV	3	3	0	1	0.3
HBV	4	4	0	1	0.3
HBV	5	1	0	0	0.1
HBV	6	5	0	1	0.4
HBV	7	5	0	1	0.4
HBV	8	2	0	1	0.2
HBV	9	0	0	0	0.0
HBV	10	2	0	1	0.2
HBV	11	3	0	1	0.3
HBV	12	3	0	1	0.3
HBV	13	1	0	0	0.1
HBV	14	4	0	1	0.4
HBV	15	0	0	0	0.0
HBV	16	5	0	1	0.4
HBV	17	2	0	1	0.2
HBV	18	2	0	1	0.2
HBV	19	1	0	0	0.1
HBV	20	2	0	0	0.2
HBV	21	1	0	0	0.1
HBV	22	5	0	1	0.4
HBV	23	5	0	2	0.4
HBV	24	1	0	0	0.1
HBV	25	4	0	1	0.3
HBV	26	4	0	1	0.3
HBV	27	5	0	1	0.4
HBV	28	0	0	0	0.0
HBV	29	1	0	0	0.1
HBV	30	0	0	0	0.0
HBV	31	1	0	0	0.1
HBV	32	1	0	0	0.1
HBV	33	2	0	1	0.2
HC	1	3	0	1	0.3
HC	2	3	0	1	0.3
HC	3	6	0	1	0.5
HC	4	6	0.5	1	0.5
HC	5	4	0	1	0.3
HC	6	13	1	2	1.1
HC	7	1	0	0	0.1
HC	8	11	1	1	0.9
HC	9	5	0	1	0.4
HC	10	5	0	1	0.4
HC	11	4	0	1	0.3
HC	12	1	0	0	0.1
HC	13	1	0	0	0.1
HC	14	1	0	0.5	0.1
HC	15	3	0	1	0.3
HC	16	1	0	0	0.1
HC	17	2	0	1	0.2
HC	18	1	0	0	0.1
HC	19	2	0	1	0.2
HC	20	2	0	1	0.2
HC	21	6	0	2	0.5
HC	22	3	0	1	0.3
HC	23	3	0	1	0.3

Site	Series	Total	Median	Range	Mean
HC	24	6	0.5	1	0.5
HC	25	1	0	0	0.1
HC	26	6	0	1	0.5
HC	27	1	0	0	0.1
HC	28	5	0	1	0.4
HC	29	2	0	1	0.2
HC	30	4	0	1	0.3
HC	31	3	0	1	0.3
HC	32	2	0	1	0.2
HC	33	2	0	1	0.2
Reef	1	9	0	2	0.8
Reef	2	12	1	2	1.0
Reef	3	3	0	1	0.3
Reef	4	1	0	0	0.1
Reef	5	7	0	2	0.6
Reef	6	2	0	1	0.2
Reef	7	3	0	1	0.3
Reef	8	2	0	1	0.2
Reef	9	0	0	0	0.0
Reef	10	0	0	0	0.0
Reef	11	1	0	0	0.1
Reef	12	0	0	0	0.0
Reef	13	6	0.5	1	0.5
Reef	14	2	0	1	0.2
Reef	15	1	0	0	0.1
Reef	16	2	0	1	0.2
Reef	17	2	0	1	0.2
Reef	18	2	0	1	0.2
Reef	19	4	0	1	0.3
Reef	20	24	1.5	4	2.0
Reef	21	20	1	3	1.7
Reef	22	8	0	2	0.7
Reef	23	8	0	2	0.7
Reef	24	12	1	3	1.0
Reef	25	14	1	3	1.2
Reef	26	4	0	1	0.3
Reef	27	7	0	2	0.6
Reef	28	6	0.5	1	0.5
Reef	29	5	0	1	0.4
Reef	30	6	0	1	0.5
Reef	31	10	1	2	0.8
Reef	32	16	1	3	1.3
Reef	33	14	1	2	1.2
ShB	1	5	0	1	0.4
ShB	2	8	0	3	0.7
ShB	3	7	0	2	0.6
ShB	4	2	0	1	0.2
ShB	5	1	0	0	0.1
ShB	6	2	0	1	0.2
ShB	7	3	0	1	0.3
ShB	8	3	0	1	0.3
ShB	9	5	0	1	0.4
ShB	10	2	0	1	0.2
ShB	11	1	0	0	0.1
ShB	12	1	0	0	0.1
ShB	13	2	0	1	0.2
ShB	14	3	0	1	0.3
ShB	15	0	0	0	0.0

Species*: Glycera* sp. cont.

Site	Series	Total	Median	Range	Mean
ShB	16	0	0	0	0.0
ShB	17	0	0	0	0.0
ShB	18	2	0	1	0.2
ShB	19	2	0	0	0.2
ShB	20	1	0	0	0.1
ShB	21	9	0	2	0.8
ShB	22	7	1	1	0.6
ShB	23	8	0	0	0.7
ShB	24	3	0	1	0.3
ShB	25	0	0	0	0.0
ShB	26	2	0	1	0.2
ShB	27	7	0	2	0.6
ShB	28	6	0	1	0.5
ShB	29	3	0	1	0.3
ShB	30	3	0	1	0.3
ShB	31	6	0	1	0.5
ShB	32	4	0	1	0.3
ShB	33	5	0	1	0.4
Whau	1	0	0	0	0.0
Whau	2	6	0.5	1	0.5
Whau	3	6	0	2	0.5
Whau	4	7	0	2	0.6
Whau	5	5	0	1	0.4
Whau	6	5	0	1	0.4
Whau	7	3	0	1	0.3
Whau	8	5	0	1	0.4
Whau	9	5	0	1	0.4
Whau	10	0	0	0	0.0
Whau	11	5	0	1	0.4
Whau	12	3	0	1	0.3
Whau	13	3	0	1	0.3
Whau	14	3	0	1	0.3
Whau	15	4	0	1	0.3
Whau	16	2	0	1	0.2
Whau	17	3	0	1	0.3
Whau	18	1	0	0	0.1
Whau	19	2	0	0	0.2
Whau	20	6	0.5	1	0.5
Whau	21	4	0	1	0.3
Whau	22	4	0	1	0.3
Whau	23	10	1	1	0.8
Whau	24	5	0	1	0.4
Whau	25	2	0	1	0.2
Whau	26	3	0	1	0.3
Whau	27	0	0	0	0.0
Whau	28	1	0	0	0.1
Whau	29	1	0	0	0.1
Whau	30	2	0	1	0.2
Whau	31	0	0	0	0.0
Whau	32	2	0	1	0.2
Whau	33	7	0.5	1	0.6

Species: *Haminoea zelandiae*

Site	Series	Total	Median	Range	Mean
HBV	1	0	0	0	0.0
HBV	2	0	0	0	0.0
HBV	3	0	0	0	0.0
HBV	4	0	0	0	0.0
HBV	5	0	0	0	0.0
HBV	6	0	0	0	0.0
HBV	7	0	0	0	0.0
HBV	8	0	0	0	0.0
HBV	9	0	0	0	0.0
HBV	10	1	0	0	0.1
HBV	11	0	0	0	0.0
HBV	12	0	0	0	0.0
HBV	13	0	0	0	0.0
HBV	14	0	0	0	0.0
HBV	15	0	0	0	0.0
HBV	16	0	0	0	0.0
HBV	17	1	0	0	0.1
HBV	18	0	0	0	0.0
HBV	19	0	0	0	0.0
HBV	20	0	0	0	0.0
HBV	21	0	0	0	0.0
HBV	22	0	0	0	0.0
HBV	23	0	0	0	0.0
HBV	24	0	0	0	0.0
HBV	25	0	0	0	0.0
HBV	26	0	0	0	0.0
HBV	27	1	0	0	0.1
HBV	28	1	0	0	0.1
HBV	29	0	0	0	0.0
HBV	30	0	0	0	0.0
HBV	31	0	0	0	0.0
HBV	32	0	0	0	0.0
HBV	33	2	0	1	0.2
HC	1	2	0	0	0.2
HC	2	0	0	0	0.0
HC	3	1	0	0	0.1
HC	4	5	0	1	0.4
HC	5	0	0	0	0.0
HC	6	0	0	0	0.0
HC	7	0	0	0	0.0
HC	8	3	0	1	0.3
HC	9	0	0	0	0.0
HC	10	1	0	0	0.1
HC	11	2	0	1	0.2
HC	12	0	0	0	0.0
HC	13	0	0	0	0.0
HC	14	0	0	0	0.0
HC	15	0	0	0	0.0
HC	16	0	0	0	0.0
HC	17	3	0	1	0.3
HC	18	0	0	0	0.0
HC	19	0	0	0	0.0
HC	20	4	0	1	0.3
HC	21	7	0	2	0.6
HC	22	0	0	0	0.0
HC	23	1	0	0	0.1

Site	Series	Total	Median	Range	Mean
HC	24	0	0	0	0.0
HC	25	2	0	1	0.2
HC	26	1	0	0	0.1
HC	27	5	0	1	0.4
HC	28	6	0	1	0.5
HC	29	5	0	1	0.4
HC	30	0	0	0	0.0
HC	31	1	0	0	0.1
HC	32	0	0	0	0.0
HC	33	1	0	0	0.1
Reef	1	10	0.5	2	0.8
Reef	2	20	1.5	4	1.7
Reef	3	3	0	1	0.3
Reef	4	4	0	1	0.3
Reef	5	2	0	1	0.2
Reef	6	4	0	1	0.3
Reef	7	1	0	0	0.1
Reef	8	8	0.5	2	0.7
Reef	9	10	1	2	0.8
Reef	10	3	0	1	0.3
Reef	11	1	0	0	0.1
Reef	12	0	0	0	0.0
Reef	13	0	0	0	0.0
Reef	14	1	0	0.5	0.1
Reef	15	33	2.5	4	2.8
Reef	16	2	0	1	0.2
Reef	17	5	0	2	0.4
Reef	18	6	0	1	0.5
Reef	19	8	0.5	2	0.7
Reef	20	29	2	6	2.4
Reef	21	46	1	11	3.8
Reef	22	24	0.5	6	2.0
Reef	23	18	1	4	1.5
Reef	24	14	1	4	1.2
Reef	25	1	0	0	0.1
Reef	26	9	0	2	0.8
Reef	27	11	1	2	0.9
Reef	28	0	0	0	0.0
Reef	29	17	1	3	1.4
Reef	30	17	1.5	3	1.4
Reef	31	4	0	1	0.3
Reef	32	0	0	0	0.0
Reef	33	0	0	0	0.0
ShB	1	0	0	0	0.0
ShB	2	0	0	0	0.0
ShB	3	1	0	0	0.1
ShB	4	0	0	0	0.0
ShB	5	0	0	0	0.0
ShB	6	0	0	0	0.0
ShB	7	0	0	0	0.0
ShB	8	2	0	1	0.2
ShB	9	1	0	0	0.1
ShB	10	0	0	0	0.0
ShB	11	0	0	0	0.0
ShB	12	0	0	0	0.0
ShB	13	0	0	0	0.0
ShB	14	4	0	2	0.4
ShB	15	5	0	1	0.4

Species: *Haminoea zelandiae* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	2	0	1	0.2
ShB	17	1	0	0	0.1
ShB	18	0	0	0	0.0
ShB	19	0	0	0	0.0
ShB	20	14	0	2	1.2
ShB	21	5	0	1	0.4
ShB	22	0	0	0	0.0
ShB	23	0	0	0	0.0
ShB	24	0	0	0	0.0
ShB	25	3	0	1	0.3
ShB	26	3	0	1	0.3
ShB	27	2	0	0	0.2
ShB	28	0	0	0	0.0
ShB	29	0	0	0	0.0
ShB	30	0	0	0	0.0
ShB	31	0	0	0	0.0
ShB	32	0	0	0	0.0
ShB	33	5	0	1	0.4
Whau	1	0	0	0	0.0
Whau	2	1	0	0	0.1
Whau	3	7	0.5	1	0.6
Whau	4	0	0	0	0.0
Whau	5	0	0	0	0.0
Whau	6	1	0	0	0.1
Whau	7	1	0	0	0.1
Whau	8	2	0	1	0.2
Whau	9	7	0.5	1	0.6
Whau	10	0	0	0	0.0
Whau	11	0	0	0	0.0
Whau	12	0	0	0	0.0
Whau	13	0	0	0	0.0
Whau	14	0	0	0	0.0
Whau	15	9	0.5	2	0.8
Whau	16	2	0	1	0.2
Whau	17	2	0	1	0.2
Whau	18	0	0	0	0.0
Whau	19	0	0	0	0.0
Whau	20	43	3	5	3.6
Whau	21	9	0.5	2	0.8
Whau	22	0	0	0	0.0
Whau	23	3	0	1	0.3
Whau	24	2	0	1	0.2
Whau	25	0	0	0	0.0
Whau	26	0	0	0	0.0
Whau	27	15	1	3	1.3
Whau	28	0	0	0	0.0
Whau	29	0	0	0	0.0
Whau	30	0	0	0	0.0
Whau	31	0	0	0	0.0
Whau	32	5	0	1	0.4
Whau	33	4	0	1	0.3

Species: *Heteromastus filiformis*

Site	Series	Total	Median	Range	Mean
HBV	1	0	0	0	0.0
HBV	2	1	0	0	0.1
HBV	3	1	0	0	0.1
HBV	4	5	0	2	0.4
HBV	5	3	0	1	0.3
HBV	6	4	0	1	0.3
HBV	7	3	0	1	0.3
HBV	8	11	1	2	0.9
HBV	9	3	0	1	0.3
HBV	10	4	0	2	0.4
HBV	11	10	1	2	0.8
HBV	12	2	0	1	0.2
HBV	13	7	0	1	0.6
HBV	14	1	0	0	0.1
HBV	15	2	0	1	0.2
HBV	16	3	0	1	0.3
HBV	17	0	0	0	0.0
HBV	18	3	0	1	0.3
HBV	19	1	0	0	0.1
HBV	20	0	0	0	0.0
HBV	21	0	0	0	0.0
HBV	22	7	0	2	0.6
HBV	23	1	0	0	0.1
HBV	24	3	0	1	0.3
HBV	25	2	0	1	0.2
HBV	26	5	0	2	0.4
HBV	27	0	0	0	0.0
HBV	28	2	0	0	0.2
HBV	29	4	0	1	0.3
HBV	30	5	0	1	0.4
HBV	31	2	0	1	0.2
HBV	32	6	0	2	0.5
HBV	33	3	0	1	0.3
HC	1	4	0	1	0.3
HC	2	1	0	0	0.1
HC	3	3	0	1	0.3
HC	4	9	1	2	0.8
HC	5	13	1	2	1.1
HC	6	13	1	3	1.1
HC	7	6	0	1	0.5
HC	8	5	0	1	0.4
HC	9	13	0.5	3	1.1
HC	10	4	0	1	0.3
HC	11	6	0	1	0.5
HC	12	4	0	1	0.4
HC	13	3	0	1	0.3
HC	14	6	0.5	1	0.5
HC	15	5	0	1	0.4
HC	16	6	0	1	0.5
HC	17	3	0	1	0.3
HC	18	5	0	1	0.4
HC	19	8	0.5	2	0.7
HC	20	6	0	1	0.5
HC	21	1	0	0	0.1
HC	22	10	0.5	2	0.8
HC	23	6	0	1	0.5

Site	Series	Total	Median	Range	Mean
HC	24	7	0	1	0.6
HC	25	10	1	2	0.8
HC	26	4	0	1	0.3
HC	27	0	0	0	0.0
HC	28	0	0	0	0.0
HC	29	4	0	1	0.3
HC	30	6	0	1	0.5
HC	31	13	1	2	1.1
HC	32	4	0	1	0.3
HC	33	12	1	2	1.0
Reef	1	0	0	0	0.0
Reef	2	0	0	0	0.0
Reef	3	0	0	0	0.0
Reef	4	0	0	0	0.0
Reef	5	0	0	0	0.0
Reef	6	0	0	0	0.0
Reef	7	13	1	3	1.1
Reef	8	9	0	2	0.8
Reef	9	11	0	2	0.9
Reef	10	7	0	2	0.6
Reef	11	9	0.5	1	0.8
Reef	12	8	1	1	0.7
Reef	13	9	0	2	0.8
Reef	14	8	1	1	0.7
Reef	15	7	0	1	0.6
Reef	16	12	0.5	3	1.0
Reef	17	28	1.5	6	2.3
Reef	18	81	4.5	14	6.8
Reef	19	89	5.5	18	7.4
Reef	20	66	2.5	17	5.5
Reef	21	0	0	0	0.0
Reef	22	39	1	11	3.3
Reef	23	76	5	9	6.3
Reef	24	93	7	11	7.8
Reef	25	123	11	17	10.3
Reef	26	137	12	18	11.4
Reef	27	5	0	2	0.4
Reef	28	72	4	11	6.0
Reef	29	131	10	12	10.9
Reef	30	198	18.5	15	16.5
Reef	31	421	19.5	33	35.1
Reef	32	112	9.5	10	9.3
Reef	33	107	9	15	8.9
ShB	1	3	0	1	0.3
ShB	2	4	0	1	0.3
ShB	3	8	0.5	2	0.7
ShB	4	4	0	1	0.3
ShB	5	1	0	0	0.1
ShB	6	3	0	1	0.3
ShB	7	4	0	1	0.3
ShB	8	8	1	1	0.7
ShB	9	11	0.5	2	0.9
ShB	10	10	0.5	2	0.8
ShB	11	7	0	2	0.6
ShB	12	5	0	1	0.5
ShB	13	6	0.5	1	0.5
ShB	14	4	0	2	0.4
ShB	15	12	1	2	1.0

Species: *Heteromastus filiformis* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	4	0	1	0.3
ShB	17	17	1	3	1.4
ShB	18	8	0	2	0.7
ShB	19	19	1	5	1.6
ShB	20	22	1	2	1.8
ShB	21	8	0	1	0.7
ShB	22	28	1.5	4	2.3
ShB	23	37	2	6	3.1
ShB	24	33	1	4	2.8
ShB	25	44	4	7	3.7
ShB	26	39	2.5	8	3.3
ShB	27	31	1	7	2.6
ShB	28	31	2	7	2.6
ShB	29	65	4	8	5.4
ShB	30	11	0.5	2	0.9
ShB	31	46	4	7	3.8
ShB	32	29	2	4	2.4
ShB	33	43	3	6	3.6
Whau	1	1	0	0	0.1
Whau	2	0	0	0	0.0
Whau	3	1	0	0	0.1
Whau	4	10	1	2	0.9
Whau	5	1	0	0	0.1
Whau	6	2	0	1	0.2
Whau	7	0	0	0	0.0
Whau	8	1	0	0	0.1
Whau	9	0	0	0	0.0
Whau	10	6	0	1	0.5
Whau	11	7	0	2	0.6
Whau	12	1	0	0	0.1
Whau	13	1	0	0	0.1
Whau	14	0	0	0	0.0
Whau	15	1	0	0	0.1
Whau	16	0	0	0	0.0
Whau	17	1	0	0	0.1
Whau	18	0	0	0	0.0
Whau	19	0	0	0	0.0
Whau	20	2	0	0	0.2
Whau	21	1	0	0	0.1
Whau	22	8	0.5	2	0.7
Whau	23	3	0	1	0.3
Whau	24	2	0	1	0.2
Whau	25	4	0	1	0.3
Whau	26	7	0	2	0.6
Whau	27	0	0	0	0.0
Whau	28	0	0	0	0.0
Whau	29	1	0	0	0.1
Whau	30	4	0	1	0.3
Whau	31	3	0	1	0.3
Whau	32	2	0	1	0.2
Whau	33	3	0	1	0.3

Species: *Macomona liliana*

Site	Series	Total	Median	Range	Mean
HBV	1	10	1	2	0.9
HBV	2	28	2	4	2.3
HBV	3	23	1.5	3	1.9
HBV	4	14	1	2	1.2
HBV	5	29	2	4	2.4
HBV	6	24	2	3	2.0
HBV	7	27	2	4	2.3
HBV	8	17	1	3	1.4
HBV	9	32	3	3	2.7
HBV	10	18	2	2	1.5
HBV	11	20	1.5	3	1.7
HBV	12	8	0	2.5	0.7
HBV	13	29	2	3	2.4
HBV	14	9	1	2	0.8
HBV	15	18	1	3	1.5
HBV	16	14	1	2	1.2
HBV	17	24	2	4	2.0
HBV	18	7	0.5	1	0.6
HBV	19	15	1	2	1.3
HBV	20	7	0.5	1	0.6
HBV	21	17	2	2	1.4
HBV	22	13	1	3	1.1
HBV	23	12	1	2	1.0
HBV	24	18	1	3	1.5
HBV	25	10	1	2	0.8
HBV	26	22	1.5	4	1.8
HBV	27	21	1	3	1.8
HBV	28	20	2	3	1.7
HBV	29	25	2	4	2.1
HBV	30	25	2	4	2.1
HBV	31	28	2	4	2.3
HBV	32	7	0	2	0.6
HBV	33	20	1	4	1.7
HC	1	6	0.5	1	0.5
HC	2	8	1	1	0.7
HC	3	4	0	1	0.3
HC	4	2	0	1	0.2
HC	5	11	1	2	0.9
HC	6	7	0	1	0.6
HC	7	4	0	1	0.3
HC	8	8	0	1	0.7
HC	9	9	0	2	0.8
HC	10	5	0	1	0.4
HC	11	3	0	1	0.3
HC	12	0	0	0	0.0
HC	13	0	0	0	0.0
HC	14	2	0	1	0.2
HC	15	4	0	1	0.3
HC	16	0	0	0	0.0
HC	17	3	0	1	0.3
HC	18	4	0	1	0.3
HC	19	2	0	0	0.2
HC	20	2	0	1	0.2
HC	21	3	0	1	0.3
HC	22	8	0.5	2	0.7
HC	23	4	0	1	0.3

Site	Series	Total	Median	Range	Mean
HC	24	4	0	1	0.3
HC	25	7	0.5	1	0.6
HC	26	1	0	0	0.1
HC	27	2	0	1	0.2
HC	28	6	0	1	0.5
HC	29	6	0	2	0.5
HC	30	11	0.5	3	0.9
HC	31	13	0	3	1.1
HC	32	5	0	1	0.4
HC	33	3	0	1	0.3
Reef	1	10	1	2	0.8
Reef	2	11	1	2	0.9
Reef	3	6	0	1	0.5
Reef	4	12	1	2	1.0
Reef	5	13	1	3	1.1
Reef	6	18	1	3	1.5
Reef	7	10	1	2	0.8
Reef	8	19	2	2	1.6
Reef	9	18	1	1	1.5
Reef	10	20	2	2	1.7
Reef	11	12	1	2	1.0
Reef	12	8	1	1	0.7
Reef	13	9	0.5	2	0.8
Reef	14	10	1	2	0.9
Reef	15	12	1	2	1.0
Reef	16	20	1	4	1.7
Reef	17	21	1	4	1.8
Reef	18	23	2	2	1.9
Reef	19	38	3	5	3.2
Reef	20	25	2	3	2.1
Reef	21	15	1	2	1.3
Reef	22	32	2.5	4	2.7
Reef	23	45	3.5	6	3.8
Reef	24	17	2	2	1.4
Reef	25	30	2.5	4	2.5
Reef	26	35	3	5	2.9
Reef	27	17	1.5	3	1.4
Reef	28	24	1	6	2.0
Reef	29	61	3	5	5.1
Reef	30	40	4	4	3.3
Reef	31	25	2	3	2.1
Reef	32	17	1	1	1.4
Reef	33	8	0.5	2	0.7
ShB	1	11	1	1	0.9
ShB	2	11	1	1	0.9
ShB	3	18	1	3	1.5
ShB	4	41	3	7	3.4
ShB	5	12	1	3	1.0
ShB	6	12	1	2	1.0
ShB	7	11	1	2	0.9
ShB	8	18	1	3	1.5
ShB	9	10	1	2	0.8
ShB	10	19	1	4	1.6
ShB	11	20	1.5	3	1.7
ShB	12	16	2	2	1.4
ShB	13	10	1	1	0.8
ShB	14	9	1	1	0.8
ShB	15	14	1	2	1.2

Species: *Macomona liliana* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	8	0.5	1	0.7
ShB	17	5	0	1	0.4
ShB	18	16	1	3	1.3
ShB	19	12	1	2	1.0
ShB	20	1	0	0	0.1
ShB	21	18	1	3	1.5
ShB	22	0	0	0	0.0
ShB	23	15	1	3	1.3
ShB	24	23	1.5	2	1.9
ShB	25	21	1.5	3	1.8
ShB	26	13	1	2	1.1
ShB	27	13	1	2	1.1
ShB	28	23	1	3	1.9
ShB	29	6	0	1	0.5
ShB	30	13	1	2	1.1
ShB	31	22	1	3	1.8
ShB	32	5	0	1	0.4
ShB	33	8	0	1	0.7
Whau	1	33	3	3	2.8
Whau	2	33	2.5	4	2.8
Whau	3	25	2	3	2.1
Whau	4	67	5	5	5.6
Whau	5	21	2	3	1.8
Whau	6	19	1	3	1.6
Whau	7	27	2	3	2.3
Whau	8	25	1.5	5	2.1
Whau	9	24	2	4	2.0
Whau	10	0	0	0	0.0
Whau	11	23	2	3	1.9
Whau	12	12	1	1	1.0
Whau	13	12	1	2	1.0
Whau	14	8	1	1	0.7
Whau	15	37	3	4	3.1
Whau	16	11	1	3	0.9
Whau	17	52	4	8	4.3
Whau	18	17	1	2	1.4
Whau	19	50	3	7	4.2
Whau	20	67	6	5	5.6
Whau	21	37	3	4	3.1
Whau	22	64	5	7	5.3
Whau	23	77	5	11	6.4
Whau	24	75	4.5	12	6.3
Whau	25	93	6.5	12	7.8
Whau	26	122	9.5	15	10.2
Whau	27	103	6.5	15	8.6
Whau	28	88	6	11	7.3
Whau	29	100	6.5	11	8.3
Whau	30	111	10	11	9.3
Whau	31	92	6	11	7.7
Whau	32	102	8.5	9	8.5
Whau	33	64	5	9	5.3

Species: *Macroclymenella stewartensis*

Site	Series	Total	Median	Range	Mean
HBV	1	3	0	1	0.3
HBV	2	4	0	1	0.3
HBV	3	3	0	1	0.3
HBV	4	2	0	1	0.2
HBV	5	2	0	1	0.2
HBV	6	0	0	0	0.0
HBV	7	5	0	1	0.4
HBV	8	7	0	2	0.6
HBV	9	0	0	0	0.0
HBV	10	2	0	1	0.2
HBV	11	2	0	1	0.2
HBV	12	0	0	0	0.0
HBV	13	2	0	1	0.2
HBV	14	4	0	1	0.4
HBV	15	2	0	1	0.2
HBV	16	0	0	0	0.0
HBV	17	0	0	0	0.0
HBV	18	0	0	0	0.0
HBV	19	1	0	0	0.1
HBV	20	5	0	1	0.4
HBV	21	2	0	1	0.2
HBV	22	1	0	0	0.1
HBV	23	0	0	0	0.0
HBV	24	3	0	1	0.3
HBV	25	1	0	0	0.1
HBV	26	3	0	1	0.3
HBV	27	1	0	0	0.1
HBV	28	0	0	0	0.0
HBV	29	3	0	1	0.3
HBV	30	0	0	0	0.0
HBV	31	3	0	1	0.3
HBV	32	3	0	1	0.3
HBV	33	6	0	1	0.5
HC	1	8	0.5	1	0.7
HC	2	12	1	2	1.0
HC	3	4	0	1	0.3
HC	4	6	0.5	1	0.5
HC	5	2	0	1	0.2
HC	6	6	0	1	0.5
HC	7	15	1	3	1.3
HC	8	14	1	2	1.2
HC	9	7	0.5	1	0.6
HC	10	7	0	3	0.6
HC	11	8	0.5	1	0.7
HC	12	8	0	2	0.7
HC	13	5	0	1	0.4
HC	14	3	0	1	0.3
HC	15	3	0	1	0.3
HC	16	10	0.5	2	0.8
HC	17	5	0	1	0.4
HC	18	10	1	2	0.8
HC	19	9	0.5	2	0.8
HC	20	14	1	2	1.2
HC	21	7	0	2	0.6
HC	22	9	1	2	0.8
HC	23	0	0	0	0.0

Site	Series	Total	Median	Range	Mean
HC	24	2	0	1	0.2
HC	25	5	0	1	0.4
HC	26	8	0	1	0.7
HC	27	2	0	1	0.2
HC	28	11	1	2	0.9
HC	29	7	0.5	1	0.6
HC	30	4	0	1	0.3
HC	31	17	1	3	1.4
HC	32	18	1.5	3	1.5
HC	33	21	1	4	1.8
Reef	1	24	2	4	2.0
Reef	2	27	2	4	2.3
Reef	3	38	2.5	5	3.2
Reef	4	30	2	6	2.5
Reef	5	20	2	3	1.7
Reef	6	18	1	3	1.5
Reef	7	15	1	3	1.3
Reef	8	16	1	3	1.3
Reef	9	10	0.5	2	0.8
Reef	10	10	1	2	0.9
Reef	11	11	1	2	0.9
Reef	12	4	0	1	0.3
Reef	13	12	0.5	3	1.0
Reef	14	9	1	2	0.8
Reef	15	30	2.5	3	2.5
Reef	16	15	1	3	1.3
Reef	17	9	0.5	2	0.8
Reef	18	12	1	2	1.0
Reef	19	19	1.5	3	1.6
Reef	20	25	2	5	2.1
Reef	21	14	1	2	1.2
Reef	22	17	1.5	2	1.4
Reef	23	10	1	2	8.3
Reef	24	16	1.5	2	1.3
Reef	25	12	1	2	1.0
Reef	26	34	2.5	5	2.8
Reef	27	23	1	5	1.9
Reef	28	9	0.5	1	0.8
Reef	29	9	0.5	2	0.8
Reef	30	46	3	7	3.8
Reef	31	44	3	6	3.7
Reef	32	36	3	5	3.0
Reef	33	46	3	6	3.8
ShB	1	5	0	1	0.4
ShB	2	6	0	1	0.5
ShB	3	3	0	1	0.3
ShB	4	1	0	0	0.1
ShB	5	2	0	1	0.2
ShB	6	2	0	1	0.2
ShB	7	0	0	0	0.0
ShB	8	2	0	1	0.2
ShB	9	2	0	0	0.2
ShB	10	4	0	1	0.3
ShB	11	1	0	0	0.1
ShB	12	2	0	1	0.2
ShB	13	2	0	1	0.2
ShB	14	6	0	2	0.5
ShB	15	5	0	1	0.4

Species: *Macroclymenella stewartensis*

Site	Series	Total	Median	Range	Mean
ShB	16	3	0	1	0.3
ShB	17	2	0	1	0.2
ShB	18	2	0	1	0.2
ShB	19	0	0	0	0.0
ShB	20	1	0	0	0.1
ShB	21	4	0	1	0.3
ShB	22	4	0	1	0.3
ShB	23	0	0	0	0.0
ShB	24	1	0	0	0.1
ShB	25	4	0	1	0.3
ShB	26	12	1	3	1.0
ShB	27	6	0	2	0.5
ShB	28	7	0	1	0.6
ShB	29	1	0	0	0.1
ShB	30	4	0	2	0.3
ShB	31	3	0	1	0.3
ShB	32	4	0	1	0.3
ShB	33	7	0	1	0.6
Whau	1	29	2	3	2.4
Whau	2	33	2.5	5	2.8
Whau	3	33	2.5	3	2.8
Whau	4	3	0	1	0.3
Whau	5	26	2	2	2.2
Whau	6	24	2	3	2.0
Whau	7	38	3	5	3.2
Whau	8	71	6	5	5.9
Whau	9	61	3.5	10	5.1
Whau	10	46	2	9	3.8
Whau	11	47	4	5	3.9
Whau	12	47	3	7	3.9
Whau	13	26	2	4	2.2
Whau	14	45	3.5	7	3.8
Whau	15	31	2	5	2.6
Whau	16	36	3	6	3.0
Whau	17	24	1.5	4	2.0
Whau	18	36	3	5	3.0
Whau	19	30	2.5	4	2.5
Whau	20	58	4	6	4.8
Whau	21	31	2	5	2.6
Whau	22	53	4.5	5	4.4
Whau	23	49	5	5	4.1
Whau	24	33	2.5	5	2.8
Whau	25	121	8	9	10.1
Whau	26	0	0	0	0.0
Whau	27	44	3.5	7	3.7
Whau	28	50	4.5	7	4.2
Whau	29	45	4	5	3.8
Whau	30	53	4.5	7	4.4
Whau	31	108	10	8	9.0
Whau	32	102	8	9	8.5
Whau	33	89	6.5	11	7.4

Species: *Notoamea helmsi*

Site	Series	Total	Median	Range	Mean
HBV	1	34	2	6	2.9
HBV	2	39	2	9	3.3
HBV	3	20	1	4	1.7
HBV	4	143	9.5	28	11.9
HBV	5	150	9	22	12.5
HBV	6	133	10.5	14	11.1
HBV	7	86	6.5	12	7.2
HBV	8	83	6.5	10	6.9
HBV	9	58	4	11	4.8
HBV	10	92	6	13	7.7
HBV	11	122	9.5	17	10.2
HBV	12	106	8.5	17	8.9
HBV	13	95	9	9	7.9
HBV	14	110	9	15	9.2
HBV	15	60	5	8	5.0
HBV	16	95	6	20	7.9
HBV	17	69	4	9	5.8
HBV	18	90	7	10	7.5
HBV	19	63	4	8	5.3
HBV	20	44	4	7	3.7
HBV	21	68	4.5	10	5.7
HBV	22	53	4.5	6	4.4
HBV	23	56	4	8	4.7
HBV	24	161	12.5	19	13.4
HBV	25	113	9	14	9.4
HBV	26	118	8.5	13	9.8
HBV	27	107	8.5	15	8.9
HBV	28	104	8.5	13	8.7
HBV	29	148	13	13	12.3
HBV	30	170	11	20	14.2
HBV	31	168	13	15	14.0
HBV	32	71	3.5	13	5.9
HBV	33	31	2	5	2.6
HC	1	136	11.5	16	11.3
HC	2	44	3.5	6	3.7
HC	3	26	2	4	2.2
HC	4	43	3.5	7	3.6
HC	5	173	13	24	14.4
HC	6	245	16.5	26	20.4
HC	7	208	16.5	15	17.3
HC	8	100	7	15	8.3
HC	9	98	7	12	8.2
HC	10	189	13.5	26	15.8
HC	11	132	9	22	11.0
HC	12	182	17	17	15.2
HC	13	116	10.5	8	9.7
HC	14	118	8.5	14.5	9.9
HC	15	73	4	10	6.1
HC	16	87	6.5	12	7.3
HC	17	3	0	1	0.3
HC	18	162	13.5	14	13.5
HC	19	173	14	17	14.4
HC	20	83	4	13	6.9
HC	21	31	2	6	2.6
HC	22	102	7	15	8.5
HC	23	99	8	11	8.3
HC	24	81	5.5	14	6.8
HC	25	137	12.5	11	11.4
HC	26	68	4.5	10	5.7
HC	27	61	4	10	5.1
HC	28	64	6	8	5.3
HC	29	188	15.5	22	15.7
HC	30	298	28.5	34	24.8
HC	31	109	8.5	14	9.1
HC	32	70	5.5	11	5.8
HC	33	76	6	8	6.3
Reef	1	5	0	1	0.4
Reef	2	2	0	1	0.2
Reef	3	10	0	2	0.8
Reef	4	6	0	2	0.5
Reef	5	2	0	1	0.2
Reef	6	9	0	2	0.8
Reef	7	5	0	1	0.4
Reef	8	4	0	1	0.3
Reef	9	13	0.5	3	1.1
Reef	10	2	0	1	0.2
Reef	11	4	0	1	0.3
Reef	12	2	0	1	0.2
Reef	13	1	0	0	0.1
Reef	14	3	0	1	0.3
Reef	15	3	0	1	0.3
Reef	16	0	0	0	0.0
Reef	17	2	0	1	0.2
Reef	18	2	0	1	0.2
Reef	19	4	0	1	0.3
Reef	20	1	0	0	0.1
Reef	21	0	0	0	0.0
Reef	22	1	0	0	0.1
Reef	23	2	0	1	0.2
Reef	24	3	0	1	0.3
Reef	25	1	0	0	0.1
Reef	26	1	0	0	0.1
Reef	27	0	0	0	0.0
Reef	28	1	0	0	0.1
Reef	29	3	0	0	0.3
Reef	30	1	0	0	0.1
Reef	31	3	0	1	0.3
Reef	32	0	0	0	0.0
Reef	33	0	0	0	0.0
ShB	1	62	3.5	11	5.2
ShB	2	64	3.5	11	5.3
ShB	3	19	0.5	5	1.6
ShB	4	88	7	14	7.3
ShB	5	134	5	33	11.2
ShB	6	140	12.5	17	11.7
ShB	7	87	7	14	7.3
ShB	8	35	2	7	2.9
ShB	9	28	2	5	2.3
ShB	10	175	13	25	14.6
ShB	11	143	12.5	14	11.9
ShB	12	126	10	9	10.5
ShB	13	41	3	4	3.4
ShB	14	91	6.5	13	7.6
ShB	15	99	7	15	8.3

Species: *Notoamea helmsi*

Site	Series	Total	Median	Range	Mean
ShB	16	72	5	12	6.0
ShB	17	118	11	17	9.8
ShB	18	95	6.5	15	7.9
ShB	19	75	4	17	6.3
ShB	20	62	4	9	5.2
ShB	21	42	2.5	9	3.5
ShB	22	50	3	12	4.2
ShB	23	30	0.5	10	2.5
ShB	24	110	6	23	9.2
ShB	25	75	5.5	11	6.3
ShB	26	64	3.5	13	5.3
ShB	27	40	1.5	10	3.3
ShB	28	56	3.5	11	4.7
ShB	29	71	5	12	5.9
ShB	30	227	14	41	18.9
ShB	31	212	13	31	17.7
ShB	32	81	6.5	9	6.8
ShB	33	22	0.5	6	1.8
Whau	1	96	5	19	8.0
Whau	2	99	8	9	8.3
Whau	3	124	8.5	11	10.3
Whau	4	66	3.5	17	5.5
Whau	5	12	1	2	1.0
Whau	6	24	1	5	2.0
Whau	7	44	4	6	3.7
Whau	8	45	3	7	3.8
Whau	9	37	3.5	6	3.1
Whau	10	82	6	5	6.8
Whau	11	26	2	5	2.2
Whau	12	64	6	10	5.3
Whau	13	42	3	7	3.5
Whau	14	47	3.5	6	3.9
Whau	15	44	3.5	6	3.7
Whau	16	18	2	2	1.5
Whau	17	42	2	12	3.5
Whau	18	29	1	8	2.4
Whau	19	34	3	4	2.8
Whau	20	43	2.5	8	3.6
Whau	21	44	3.5	6	3.7
Whau	22	19	1	5	1.6
Whau	23	12	1	2	1.0
Whau	24	14	0	5	1.2
Whau	25	6	0	2	0.5
Whau	26	12	0.5	2	1.0
Whau	27	18	1	4	1.5
Whau	28	22	1.5	3	1.8
Whau	29	34	2	7	2.8
Whau	30	47	1	16	3.9
Whau	31	30	3	4	2.5
Whau	32	40	2	5	3.3
Whau	33	11	0	4	0.9

Species: *Nucula hartvigiana*

Site	Series	Total	Median	Range	Mean
HBV	1	290	21	43	24.2
HBV	2	447	30.5	59	37.3
HBV	3	527	36	70	43.9
HBV	4	646	55	48	53.8
HBV	5	520	38.5	50	43.3
HBV	6	639	59	55	53.3
HBV	7	654	55	41	54.5
HBV	8	659	61	56	54.9
HBV	9	667	56.5	68	55.6
HBV	10	712	54	48	59.4
HBV	11	667	55	64	55.6
HBV	12	600	48.5	38.5	50.0
HBV	13	817	72	67	68.1
HBV	14	760	60	57	63.4
HBV	15	526	46	44	43.8
HBV	16	586	50	41	48.8
HBV	17	476	38.5	43	39.7
HBV	18	796	73	54	66.3
HBV	19	635	50.5	58	52.9
HBV	20	704	56	36	58.7
HBV	21	600	43	72	50.0
HBV	22	643	50.5	58	50.5
HBV	23	661	49.5	62	55.1
HBV	24	592	55.5	64	49.3
HBV	25	525	48.5	70	43.8
HBV	26	541	44.5	40	45.1
HBV	27	683	59.5	49	56.9
HBV	28	503	40.5	57	41.9
HBV	29	532	40	53	44.3
HBV	30	461	35	46	38.4
HBV	31	640	53.5	44	53.3
HBV	32	554	41.5	62	46.2
HBV	33	574	47.5	37	47.8
HC	1	1150	86.5	103	95.8
HC	2	1059	84	59	88.3
HC	3	967	80	45	80.6
HC	4	1432	118.5	105	119.3
HC	5	1512	127	45	126.0
HC	6	1487	124.5	89	123.9
HC	7	1521	131	88	126.8
HC	8	1502	120	42	125.2
HC	9	1394	115	75	116.2
HC	10	1508	131	88	125.7
HC	11	1446	119	58	120.5
HC	12	1130	97	89	94.2
HC	13	1064	86.5	54	88.7
HC	14	1262	101.5	41.5	105.2
HC	15	1527	126.5	33	127.3
HC	16	1151	90	47	95.9
HC	17	1383	125	74	115.3
HC	18	1327	116	70	110.6
HC	19	1242	106	142	103.5
HC	20	1178	92.5	49	98.2
HC	21	1249	101.5	42	104.1
HC	22	1181	103	37	98.4
HC	23	1179	98	1	98.3

Site	Series	Total	Median	Range	Mean
HC	24	1064	92.5	67	88.7
HC	25	1193	100.5	48	99.4
HC	26	959	81	107	79.9
HC	27	1029	85	43	85.8
HC	28	1014	82.5	86	84.5
HC	29	1317	109	70	109.8
HC	30	1165	94.5	37	97.1
HC	31	1061	91	42	88.4
HC	32	1168	100.5	40	97.3
HC	33	1011	80	55	84.3
Reef	1	240	18	25	20.0
Reef	2	880	82.5	101	73.3
Reef	3	447	33	71	37.3
Reef	4	789	74.5	63	65.8
Reef	5	661	50.5	63	55.1
Reef	6	516	41.5	87	43.0
Reef	7	447	32.5	56	37.3
Reef	8	394	37	63	32.8
Reef	9	303	30	42	25.3
Reef	10	306	29	53	25.5
Reef	11	302	23.5	44	25.2
Reef	12	191	16.5	31	15.9
Reef	13	275	24.5	54	22.9
Reef	14	220	21	40	18.4
Reef	15	280	23.5	37	23.3
Reef	16	199	12	34	16.6
Reef	17	124	4.5	22	10.3
Reef	18	78	4.5	14	6.5
Reef	19	122	4.5	27	10.2
Reef	20	108	6.5	20	9.0
Reef	21	64	2.5	15	5.3
Reef	22	121	6.5	24	10.1
Reef	23	63	3	13	5.3
Reef	24	73	1.5	10	6.1
Reef	25	28	0	5	2.3
Reef	26	59	1	14	4.9
Reef	27	35	0.5	10	2.9
Reef	28	51	0	14	4.3
Reef	29	51	2	11	4.3
Reef	30	40	1	10	3.3
Reef	31	3	0	1	0.3
Reef	32	14	1	2	1.2
Reef	33	3	0	1	0.3
ShB	1	223	18.5	35	18.6
ShB	2	237	22	35	19.8
ShB	3	237	12	14	19.8
ShB	4	448	31.5	40	37.3
ShB	5	414	36	31	34.5
ShB	6	408	30	32	34.0
ShB	7	282	25.5	27	23.5
ShB	8	280	21.5	20	23.3
ShB	9	247	13.5	38	20.6
ShB	10	418	31	35	34.8
ShB	11	389	21	46	32.4
ShB	12	482	39	62	40.2
ShB	13	171	16	17	14.3
ShB	14	106	9.5	20	8.9
ShB	15	245	15.5	38	20.4

Species: *Nucula hartvigiana* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	327	24.5	49	27.3
ShB	17	256	17	49	21.3
ShB	18	234	20	31	19.5
ShB	19	99	4.5	20	8.3
ShB	20	218	10	43	18.2
ShB	21	121	8	23	10.1
ShB	22	84	1.5	22	7.0
ShB	23	62	4	12	5.2
ShB	24	205	4	58	17.1
ShB	25	99	1	9	8.3
ShB	26	105	2	29	8.8
ShB	27	175	3.5	61	14.6
ShB	28	34	1	8	2.8
ShB	29	21	0	6	1.8
ShB	30	60	2	10	5.0
ShB	31	65	3.5	13	5.4
ShB	32	66	2	24	5.5
ShB	33	20	1	5	1.7
Whau	1	703	54.5	84	58.6
Whau	2	811	55.5	78	67.6
Whau	3	1616	136	170	134.7
Whau	4	435	28.5	54	36.3
Whau	5	1110	94.5	80	92.5
Whau	6	1124	94	113	93.7
Whau	7	993	93	105	82.8
Whau	8	717	62.5	38	59.8
Whau	9	982	81.5	89	81.8
Whau	10	858	71.5	40	71.5
Whau	11	542	45	39	45.2
Whau	12	671	58	41	55.9
Whau	13	551	47.5	34	45.9
Whau	14	385	34	46	32.1
Whau	15	786	74	81	65.5
Whau	16	558	49.5	45	46.5
Whau	17	910	76	89	75.8
Whau	18	819	69.5	76	68.3
Whau	19	837	75.5	65	69.8
Whau	20	716	58.5	61	59.7
Whau	21	786	74	81	65.5
Whau	22	397	24	67	33.1
Whau	23	286	14	63	23.8
Whau	24	231	17.5	45	19.3
Whau	25	190	9	36	15.8
Whau	26	216	10.5	43	18.0
Whau	27	206	10	36	17.2
Whau	28	296	12.5	43	24.7
Whau	29	339	14	65	28.3
Whau	30	444	25	81	37.0
Whau	31	337	21	71	28.1
Whau	32	286	13	71	23.8
Whau	33	317	15.5	68	26.4

Species: *Paphies australis*

Site	Series	Total	Median	Range	Mean
HBV	1	46	3	8	3.9
HBV	2	39	1.5	9	3.3
HBV	3	46	3.5	7	3.8
HBV	4	85	5.5	17	7.1
HBV	5	37	4.5	5	3.1
HBV	6	77	4	12	6.4
HBV	7	38	2.5	6	3.2
HBV	8	43	2	8	3.6
HBV	9	57	0.5	24	4.8
HBV	10	60	2	18	5.0
HBV	11	31	1	8	2.6
HBV	12	48	3.5	9	4.0
HBV	13	23	1.5	5	1.9
HBV	14	62	2	7	5.2
HBV	15	89	4	21	7.4
HBV	16	65	4	13	5.4
HBV	17	21	1.5	3	1.8
HBV	18	39	2	10	3.3
HBV	19	54	3	7	4.5
HBV	20	57	1	18	4.8
HBV	21	12	0.5	3	1.0
HBV	22	38	3	7	3.2
HBV	23	26	1	5	2.2
HBV	24	49	1.5	11	4.1
HBV	25	51	3	10	4.3
HBV	26	70	3	9	5.8
HBV	27	66	3.5	12	5.5
HBV	28	41	2	9	3.4
HBV	29	75	3	12	6.3
HBV	30	43	1.5	10	3.6
HBV	31	45	1	11	3.8
HBV	32	38	1	3	3.2
HBV	33	16	0	3	1.3
HC	1	0	0	0	0.0
HC	2	0	0	0	0.0
HC	3	0	0	0	0.0
HC	4	0	0	0	0.0
HC	5	0	0	0	0.0
HC	6	1	0	0	0.1
HC	7	0	0	0	0.0
HC	8	0	0	0	0.0
HC	9	0	0	0	0.0
HC	10	0	0	0	0.0
HC	11	0	0	0	0.0
HC	12	0	0	0	0.0
HC	13	0	0	0	0.0
HC	14	0	0	0	0.0
HC	15	0	0	0	0.0
HC	16	0	0	0	0.0
HC	17	1	0	0	0.1
HC	18	0	0	0	0.0
HC	19	0	0	0	0.0
HC	20	0	0	0	0.0
HC	21	0	0	0	0.0
HC	22	0	0	0	0.0
HC	23	0	0	0	0.0

Site	Series	Total	Median	Range	Mean
HC	24	0	0	0	0.0
HC	25	0	0	0	0.0
HC	26	0	0	0	0.0
HC	27	0	0	0	0.0
HC	28	3	0	1	0.3
HC	29	0	0	0	0.0
HC	30	3	0	1	0.3
HC	31	0	0	0	0.0
HC	32	0	0	0	0.0
HC	33	0	0	0	0.0
Reef	1	0	0	0	0.0
Reef	2	0	0	0	0.0
Reef	3	0	0	0	0.0
Reef	4	0	0	0	0.0
Reef	5	1	0	0	0.1
Reef	6	1	0	0	0.1
Reef	7	3	0	1	0.3
Reef	8	0	0	0	0.0
Reef	9	0	0	0	0.0
Reef	10	0	0	0	0.0
Reef	11	0	0	0	0.0
Reef	12	2	0	1	0.2
Reef	13	1	0	0	0.1
Reef	14	0	0	0	0.0
Reef	15	0	0	0	0.0
Reef	16	0	0	0	0.0
Reef	17	0	0	0	0.0
Reef	18	0	0	0	0.0
Reef	19	0	0	0	0.0
Reef	20	0	0	0	0.0
Reef	21	0	0	0	0.0
Reef	22	0	0	0	0.0
Reef	23	0	0	0	0.0
Reef	24	5	0	2	0.4
Reef	25	0	0	0	0.0
Reef	26	0	0	0	0.0
Reef	27	0	0	0	0.0
Reef	28	31	2	4	2.6
Reef	29	0	0	0	0.0
Reef	30	0	0	0	0.0
Reef	31	0	0	0	0.0
Reef	32	2	0	1	0.2
Reef	33	3	0	1	0.3
ShB	1	0	0	0	0.0
ShB	2	0	0	0	0.0
ShB	3	0	0	0	0.0
ShB	4	0	0	0	0.0
ShB	5	1	0	0	0.1
ShB	6	1	0	0	0.1
ShB	7	2	0	1	0.2
ShB	8	1	0	0	0.1
ShB	9	0	0	0	0.0
ShB	10	0	0	0	0.0
ShB	11	0	0	0	0.0
ShB	12	2	0	0	0.2
ShB	13	3	0	1	0.3
ShB	14	0	0	0	0.0
ShB	15	0	0	0	0.0

Species: *Paphies australis* cont.

Site	Series	Total	Median	Range	Mean
ShB	16	1	0	0	0.1
ShB	17	7	0	1	0.6
ShB	18	0	0	0	0.0
ShB	19	2	0	1	0.2
ShB	20	2	0	1	0.2
ShB	21	0	0	0	0.0
ShB	22	0	0	0	0.0
ShB	23	7	0	0	0.6
ShB	24	1	0	0	0.1
ShB	25	1	0	0	0.1
ShB	26	0	0	0	0.0
ShB	27	1	0	0	0.1
ShB	28	5	0	1	0.4
ShB	29	0	0	0	0.0
ShB	30	1	0	0	0.1
ShB	31	1	0	0	0.1
ShB	32	1	0	0	0.1
ShB	33	6	0	1	0.5
Whau	1	0	0	0	0.0
Whau	2	0	0	0	0.0
Whau	3	0	0	0	0.0
Whau	4	3	0	1	0.3
Whau	5	0	0	0	0.0
Whau	6	0	0	0	0.0
Whau	7	0	0	0	0.0
Whau	8	23	1.5	4	1.9
Whau	9	0	0	0	0.0
Whau	10	0	0	0	0.0
Whau	11	0	0	0	0.0
Whau	12	0	0	0	0.0
Whau	13	0	0	0	0.0
Whau	14	0	0	0	0.0
Whau	15	0	0	0	0.0
Whau	16	0	0	0	0.0
Whau	17	0	0	0	0.0
Whau	18	1	0	0	0.1
Whau	19	0	0	0	0.0
Whau	20	0	0	0	0.0
Whau	21	0	0	0	0.0
Whau	22	0	0	0	0.0
Whau	23	0	0	0	0.0
Whau	24	2	0	1	0.2
Whau	25	0	0	0	0.0
Whau	26	0	0	0	0.0
Whau	27	0	0	0	0.0
Whau	28	0	0	0	0.0
Whau	29	5	0	1	0.4
Whau	30	4	0	1	0.3
Whau	31	0	0	0	0.0
Whau	32	0	0	0	0.0
Whau	33	4	0	1	0.3

Species: *Zeacumantus lutulentus*

Site	Series	Total	Median	Range	Mean
HBV	1	2	0	0	0.2
HBV	2	1	0	0	0.1
HBV	3	0	0	0	0.0
HBV	4	0	0	0	0.0
HBV	5	0	0	0	0.0
HBV	6	0	0	0	0.0
HBV	7	0	0	0	0.0
HBV	8	0	0	0	0.0
HBV	9	1	0	0	0.1
HBV	10	0	0	0	0.0
HBV	11	0	0	0	0.0
HBV	12	0	0	0	0.0
HBV	13	0	0	0	0.0
HBV	14	3	0	1	0.3
HBV	15	0	0	0	0.0
HBV	16	2	0	1	0.2
HBV	17	7	0.5	1	0.6
HBV	18	1	0	0	0.1
HBV	19	4	0	2	0.3
HBV	20	3	0	1	0.3
HBV	21	5	0	1	0.4
HBV	22	1	0	0	0.1
HBV	23	0	0	0	0.0
HBV	24	11	0.5	3	0.9
HBV	25	11	0	3	0.9
HBV	26	7	0	2	0.6
HBV	27	16	1	5	1.3
HBV	28	19	1	3	1.6
HBV	29	10	1	2	0.8
HBV	30	18	2	2	1.5
HBV	31	20	1	4	1.7
HBV	32	0	0	0	0.0
HBV	33	22	0.5	5	1.8
HC	1	0	0	0	0.0
HC	2	1	0	0	0.1
HC	3	0	0	0	0.0
HC	4	1	0	0	0.1
HC	5	1	0	0	0.1
HC	6	1	0	0	0.1
HC	7	1	0	0	0.1
HC	8	0	0	0	0.0
HC	9	0	0	0	0.0
HC	10	3	0	1	0.3
HC	11	5	0	1	0.4
HC	12	2	0	0	0.2
HC	13	0	0	0	0.0
HC	14	0	0	0	0.0
HC	15	9	0	2	0.8
HC	16	5	0	1	0.4
HC	17	13	1	2	1.1
HC	18	14	1	2	1.2
HC	19	6	0	1	0.5
HC	20	9	0	2	0.8
HC	21	27	1.5	5	2.3
HC	22	16	1.5	3	1.3
HC	23	36	2.5	6	3.0

Site	Series	Total	Median	Range	Mean
HC	24	39	3	7	3.3
HC	25	21	1.5	3	1.8
HC	26	27	2	4	2.3
HC	27	26	2	4	2.2
HC	28	30	1	5	2.5
HC	29	52	4	5	4.3
HC	30	41	2	8	3.4
HC	31	55	3.5	7	4.6
HC	32	0	0	0	0.0
HC	33	65	5	7	5.4
Reef	1	25	2	4	2.1
Reef	2	8	0	2	0.7
Reef	3	31	2	5	2.6
Reef	4	11	0	2	0.9
Reef	5	0	0	0	0.0
Reef	6	2	0	1	0.2
Reef	7	0	0	0	0.0
Reef	8	2	0	1	0.2
Reef	9	2	0	1	0.2
Reef	10	3	0	1	0.3
Reef	11	4	0	1	0.3
Reef	12	0	0	0	0.0
Reef	13	0	0	0	0.0
Reef	14	9	0	3.5	0.8
Reef	15	15	1	3	1.3
Reef	16	10	1	1	0.8
Reef	17	17	1	4	1.4
Reef	18	7	0	2	0.6
Reef	19	11	1	2	0.9
Reef	20	14	0.5	3	1.2
Reef	21	18	1	4	1.5
Reef	22	4	0	1	0.3
Reef	23	21	2	3	1.8
Reef	24	14	1	4	1.2
Reef	25	11	0.5	2	0.9
Reef	26	18	1	3	1.5
Reef	27	27	2	4	2.3
Reef	28	21	0.5	4	1.8
Reef	29	39	3.5	5	3.3
Reef	30	42	3	8	3.5
Reef	31	28	2	4	2.3
Reef	32	2	0	1	0.2
Reef	33	0	0	0	0.0
ShB	1	0	0	0	0.0
ShB	2	0	0	0	0.0
ShB	3	0	0	0	0.0
ShB	4	0	0	0	0.0
ShB	5	0	0	0	0.0
ShB	6	0	0	0	0.0
ShB	7	0	0	0	0.0
ShB	8	0	0	0	0.0
ShB	9	0	0	0	0.0
ShB	10	0	0	0	0.0
ShB	11	1	0	0	0.1
ShB	12	0	0	0	0.0
ShB	13	0	0	0	0.0
ShB	14	0	0	0	0.0
ShB	15	0	0	0	0.0

Species: *Zeacumantus lutulentus*

Site	Series	Total	Median	Range	Mean
ShB	16	0	0	0	0.0
ShB	17	0	0	0	0.0
ShB	18	0	0	0	0.0
ShB	19	0	0	0	0.0
ShB	20	0	0	0	0.0
ShB	21	0	0	0	0.0
ShB	22	0	0	0	0.0
ShB	23	1	0	0	0.1
ShB	24	3	0	1	0.3
ShB	25	1	0	0	0.1
ShB	26	0	0	0	0.0
ShB	27	1	0	0	0.1
ShB	28	2	0	0	0.2
ShB	29	0	0	0	0.0
ShB	30	1	0	0	0.1
ShB	31	2	0	1	0.2
ShB	32	0	0	0	0.0
ShB	33	0	0	0	0.0
Whau	1	1	0	0	0.1
Whau	2	9	0.5	1	0.8
Whau	3	1	0	0	0.1
Whau	4	13	1	2	1.1
Whau	5	0	0	0	0.0
Whau	6	1	0	0	0.1
Whau	7	3	0	1	0.3
Whau	8	1	0	0	0.1
Whau	9	4	0	1	0.3
Whau	10	1	0	0	0.1
Whau	11	0	0	0	0.0
Whau	12	0	0	0	0.0
Whau	13	0	0	0	0.0
Whau	14	0	0	0	0.0
Whau	15	4	0	1	0.3
Whau	16	1	0	0	0.1
Whau	17	6	0.5	1	0.5
Whau	18	0	0	0	0.0
Whau	19	3	0	1	0.3
Whau	20	2	0	1	0.2
Whau	21	4	0	1	0.3
Whau	22	0	0	0	0.0
Whau	23	2	0	1	0.2
Whau	24	8	0	3	0.7
Whau	25	7	0	1	0.6
Whau	26	7	0	2	0.6
Whau	27	5	0	2	0.4
Whau	28	9	1	2	0.8
Whau	29	5	0	1	0.4
Whau	30	0	0	0	0.0
Whau	31	8	0.5	2	0.7
Whau	32	7	1	1	0.6
Whau	33	6	0.5	1	0.5